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INTERNATIONAL

MAY 1951

VOLUME 26 • NUMBER 5

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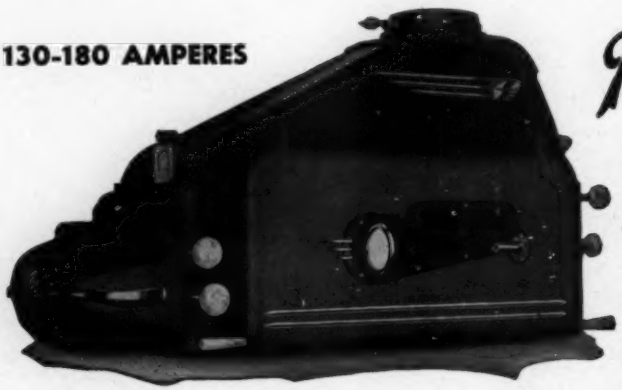

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HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

IT REMAINED for Peter Mole, president of the SMPTE, to point up one of the chief reasons for the present sluggish state of the motion picture theater box-office and at the same time deliver a stinging rebuke to the "leaders" of the film industry. Speaking at the recent convention of the Society, Mr. Mole laid it right on the line, as follows:

"Technical contributions already at hand are so far ahead of the industry's willingness to accept them that the lack of interest may have the effect of applying a brake on future technical growth." The SMPTE prexy went on to enumerate these advances in the art: stereoscopy, multiple sound tracks, more and better color, wide-angle pictures, and theater Tv.

The foregoing is practically a verbatim transcript of a theme which has been played in this column on several occasions. As far back as 1948 this corner stated flatly that the aforementioned advances were ready and awaiting only their adoption by the industry. Again, in January, 1949, we opined:

"Three-dimensional pictures, stereophonic sound, and greatly improved color processes are but three of the advances long promised by the film industry. But it begins to look as though the Big Brass have become very coy about putting money into technological developments on behalf of an industry which, while the source of their personal power and opulence, might possibly be in for a bit of rough going . . . these developments would be duck soup for that gang of technicians who have brought Tv to its comparatively high estate."

All of the aforementioned Big Brass are eager beavers when it comes to attending swank public functions, or receiving plaques for "accomplishment," or orating before some unsuspecting Chamber of Commerce or a group of newspaper editors (the latter resulting in fulsome newspaper space). But when it comes to taking positive action to aid the industry which harbored them for so many years (and we *mean* "harbored") their mental nakedness is appallingly revealed.

Lush cash surpluses abound in the film industry, both production and exhibition, but these are scrupulously maintained as a sort of perpetual reminder of the management "genius" of their guardians. We call it not a reminder but a monument, because that is precisely the function it will serve if positive action looking toward the aid of the theater field is not taken soon.

If industry management continues to chant "How much will it cost?" the time is not far off when they will be forced to turn their attention from the comparatively easy racket of mulcting theaters *via* exorbitant film rentals and go out into the market place and compete with some real brains in the advertising and Tv fields.

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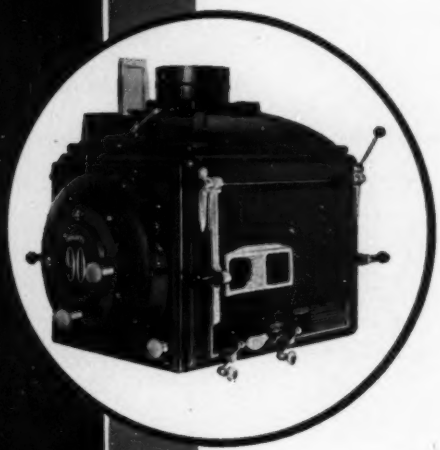

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VOLUME XXVI MAY 1951 NUMBER 5

The Differential Carbon-Feed System†

By ARTHUR J. HATCH
Strong Electric Corporation

Various fragmentary portions of this paper have been published, but appended is the official transcript as released by the SMPTE. The differential carbon-feed system applies a new principle in meeting the exacting requirements of arclamp automatic carbon feed and positioning.

THE allowable tolerance in carbon crater position has been reduced by the use of the higher-speed lamphouse optics, while the difficulty of maintaining the arc crater at a given position has been increased by the high brightness carbons with their higher burning rates. These higher burning rates are unfortunately accompanied by greater fluctuations of burning rate with small current changes.

These factors have made it desirable to incorporate automatic means in the carbon feed to maintain the position of the positive crater accurately to the lamphouse optical system.

Basic Feed Requirements

This problem of providing automatic positioning to the positive crater of high-intensity projection arc lamps has necessitated a review of the requirements for carbon feeds, as such a positioning control cannot be conveniently or effectively inserted into the type of feed mechanisms in general use at present. Accordingly, to utilize an automatic positioning device it has been necessary to develop a new carbon-feed system.

We find that the principal end results desired are uniform and constant intensity of screen illumination with constant color temperature. These results should be obtained through a carbon-feed system that has simple control adjustments and which is capable of self-compensation for changes in the variables, without attention from the projectionist.

The major electrical controlling factor necessary to obtain constant screen illumination, with a given carbon trim, is constant arc amperage. With proper arc circuit ballast, the arc amperage will assume a value such that the sum of the positive and negative carbon-burning rates, at that arc current, equals the sum of the positive and negative feed rates. Then, assuming for the moment that the carbon-burning rates are constant for a given current, it will be readily seen that a constant total feed rate will provide most even illumination.

Therefore, a very simple carbon-feed mechanism could be constructed which would advance the relative positions of the carbon holders one to the other at the constant rate necessary to maintain the desired current.

The negative carbon could stand still and the positive carbon could be advanced at a rate equal to the total burning rate of both carbons; or the positive could stand still and the negative could advance at the total rate. Any number of positive and negative feed ratios could be used as long as the combined feed added to the figure desired for total feed.

Division of Total Feed

This simple feed, however, would not take into account the fact that to utilize the illumination from the carbon arc for projection, the positive crater must be kept at the exact entrance focal position of the lamphouse optical system. It is, necessary therefore, to make provision to divide the total feed into positive and negative feeds, in a proportion exactly equal to the positive and negative burning rates at the particular current desired, in order to maintain the position of the positive crater to the optical system.

This division of the total feed into its components needs to be flexible, unless the lamp is to be burned at a single current, as the ratio between positive and negative burning rates varies considerably through the current range of the carbons.

An Ideal Feed System

The operation of this ratio-fixing control should not affect the sum total feed rate of the positive and negative carbons. For this reason, a ratio-changing system is necessary in which, if the negative feed is slowed down, the positive feed is increased simultaneously so that total carbon feed and constant current are maintained.

An ideal feed system would be one in which one control determined the total

† J. Soc. Mot. Pict. & Tv Eng., Feb. 1951.

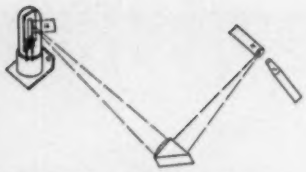

FIG. 1. Carbon position-detecting optical system, showing prism lens and bimetallic switch.

feed and the other control determined the ratio between positive and negative feeds. With a system of this type, the total feed control could be set for the desired amperage, and the ratio control adjusted until the feed ratio matched the burning ratio. This second adjustment would not affect the feed-control setting.

Thus, for example, with a 7-mm negative and 8-mm positive copper-coated, high-intensity trim the total burning rate for both carbons at 70 amps is approximately 20 in./hr. The current selector would be set to produce this total rate of feed. Then the ratio control would be adjusted, until the position of the burning tip of the positive carbon in relation to the optical system was correct and its relative movement reduced to zero.

It thus might be found necessary to adjust the ratio control setting so that the negative feeds 4 in./hr., and the positive, 16 in./hr.; or the negative might be fed 4¼ in./hr., and the positive, 15¾ in./hr. In either case the total feed would remain at 20 in./hr., and the arc current at 70 amps.

An ideal feeding system can be realized with the use of a two-motor drive. One motor, the feed motor, drives both carbons through a differential gear drive. The second, or rate-control motor, is connected preferably in the negative drive. The resultant difference in drive between the feed motor and the rate-control motor is transmitted to the positive carbon feed. Gear ratios are chosen so that the resultant total feed of both carbons is, at all ratios, a constant as determined by the speed of the main drive.

Need for Automatic Position

This feeding system and almost all present arc feeding systems make an assumption that there will be little or no variation in arc gap length, carbon-burning rate or power supply voltage. However, in practical experience these ideal conditions are seldom satisfied.

Variations in carbon-burning rates and ratios at a given current, of course, directly reflect a change of position of the arc with respect to the lamphouse optical system. Arc-gap lengths at identical currents, and even with constant applied arc voltage, will vary from trim to trim and even within a trim.

With constant arc current, the dependent variable that compensates for variation in arc supply voltage is the arc-gap length. As the positive carbon has the highest burning rate (being approximately 2 to 8 times that of the negative carbon), the major adjustment in position for variations in arc-gap length occurs in the position of the positive carbon. Thus, variations of arc voltage or gap length directly affect the position of the positive crater in relation to the optical system.

Therefore, to adopt the ideal carbon-feed system to these practical considerations, there must be introduced an element that will maintain the positive crater at the optical focal point regardless of variation in arc gap or burning rate.

Bimetal Control Element

It is, therefore, practical to introduce a carbon crater position-detecting and ratio control-actuating mechanism into this system to accomplish this end. The bimetallic element with its ruggedness and simplicity seems to be most practical for this position detector.

This bimetal switch is simply arranged to shunt out a series resistance in the ratio-motor field circuit. With all resistance shunted out, the ratio motor runs at a speed such that the negative carbon is fed at a rate below its burning rate, and the positive is fed at a rate above its burning rate. When the resistance is inserted by action of the bimetal switch, the negative is fed at a rate above, and the positive at a rate below, its burning rate.

Total rate of feed at any selected amperage is obtained from the main-drive motor, and the position of the positive carbon is accurately maintained with the controlled variation of the ratio motor.

With the use of angle-trim lamps, the general considerations for constant illumination remain the same, with the exception that to maintain this even illumination the feed rate of the negative has to be corrected for its angular direction before it can be added to the positive to obtain the value for combined total feed.

It has been confirmed by experiment that, within a reasonable limit of movement, if the positive carbon is underfed a certain amount, X, an overfeed of the negative equal in amount to X cosine α will maintain constant arc current, where α is the depression angle of the negative in relation to the positive.

Taking advantage of the uniform and predictable speed characteristics of the D-C shunt motor, it is possible to design an electrical differential motor feed circuit whereby the use of the mechanical differential is eliminated. With this arrangement, each carbon is driven by a separate motor. Such a system, without an automatic position-control switch, would contain two controls, each consisting of two rheostats connected in mechanical tandem.

Each of the rheostats in the total feed-rate control would be connected in the field circuit of its respective motor, and the resistance values arranged so that the carbon-feed speeds were changed approximately in their correct values throughout the entire current range of the carbons.

The ratio-control rheostats would be connected in the two-motor field circuits in such a manner that as the ratio control was advanced, the positive feed motor would be slowed and the negative feed motor would be speeded the correct amount to maintain the same current in the lamphouse.

For automatic positioning, the bimetal-

FIG. 2. General view of differential feed burner from operating side, showing positive and negative feeds and the single adjustment control.

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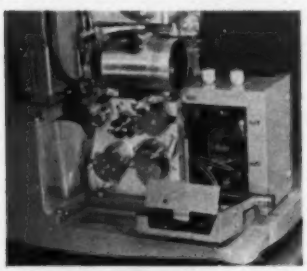

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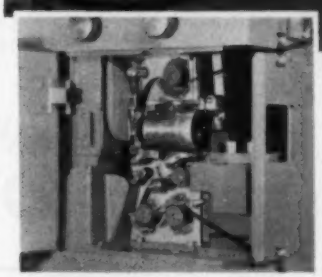

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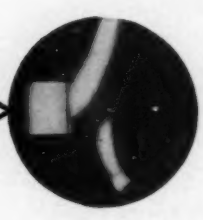

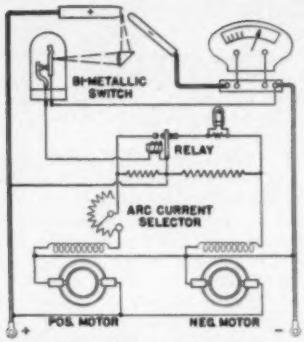

FIG. 3. Simplified arc control circuit diagram.

lic element would be arranged to shunt in and out portions of this ratio-control rheostat. The general optical arrangement for projecting the energy image of the positive carbon and flame to the bimetallic switch is shown in Fig. 1. The 90° prism with a lens ground in one face is used to direct the side view of the arc to the glass-enclosed bimetallic switch.

Single-Feed Control

It is possible to obtain D-C shunt motors with speed characteristics such that as the arc voltage is raised, consistent with higher arc currents, the negative feed motor will increase in speed approximately the right amount to compensate for the increased negative burning rate.

This fact, in conjunction with the use of a fairly large speed differential on both motors, controlled by means of the position-sensitive device, has enabled considerable simplification of the control circuit.

The net result has been the development of a circuit in which complete control of both carbon feeds throughout their entire amperage range has been accomplished with but a single lamphouse feed-control adjustment. This control is in the form of a single rheostat which is provided with a pointer and a scale-indicating arc amperages.

The general arrangement of components of a burner incorporating this two-motor, single-control feed system as viewed from the operating side is shown in Fig. 2. A simplified wiring diagram of this system is shown in Fig. 3.

The rheostat is connected in the positive feed motor field circuit and has a value sufficient to control the feed of the positive carbon through a range of from 14 to 32 in./hr.

The bimetallic switch is connected in such a manner that in its open position a resistor is inserted in the positive field, and a resistance is shunted out in the negative field, thus speeding the positive and simultaneously slowing the negative. When the bimetallic switch is closed by reason of the positive carbon position being slightly too near the optical system, the resistor in the positive field circuit is shunted, and the resistor is simultaneously inserted in the negative field circuit, thus slowing the positive and speeding the negative.

The positive motor will change speed sufficiently with this cycling to change the feed rate by approximately 4 in./hr. from fast to slow rate. With the negative carbon being depressed at an angle of 52°, its feed rate is arranged to change $4 \times \cos 52°$, or approximately 2.5 in./hr. from fast to slow.

When the arc current selector rheostat is set at the desired current, the positive motor assumes a speed such that the average speed between high- and low-cycle speeds is equal to the average burning rate of the positive carbon at the selected current.

If the arc current at a particular instant is slightly less than the selected current, the positive burning rate will be slightly lower than the average positive feed rate. Consequently, the arc position-control switch will remain in the low-speed positive feed position longer at a time, than in the high-speed positive feed position. This will cause the negative to be fed at a greater average rate than it is being consumed, thereby shortening the arc gap and raising the current, until an equilibrium condition is reached, at which the average negative and positive burning rates equal the average feed rates. This will be realized at approximately a 50% division of time on high and low speeds.

If the arc current, and consequently the positive burning rate, is higher than the selected rate, the arc position-control switch will remain in the high-speed position longer at a time than in the low-speed position. This will cause the negative to be fed at a lower than average

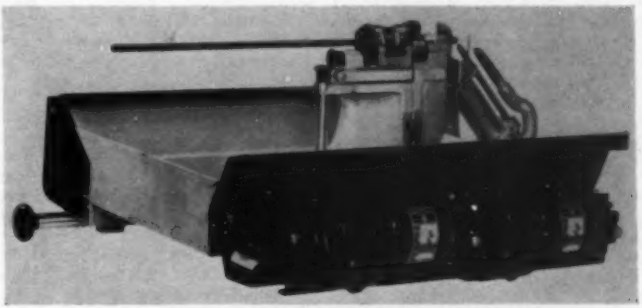

FIG. 4. General view of burner from non-operating side, showing motors and bimetallic switch behind left motor.

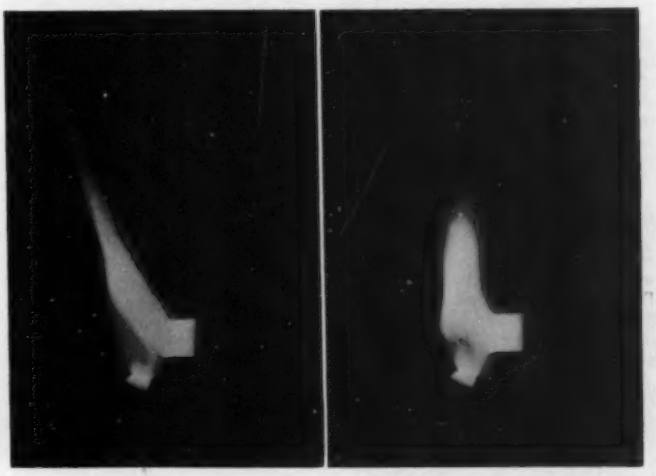

FIG. 5 *(a)*. The arc burning with no air supplied from jet, the characteristic long tail-flame reaching toward the optical system.

FIG. 5 *(b)*. The burning arc, showing how the application of air from the jet shortens and redirects the flame.

rate, thereby lengthening the arc gap until equilibrium is reached.

Slow changes in power supply voltage are compensated for by the automatic resulting change in arc-gap length, but with the continual maintenance of the positive crater at the required position.

Miscellaneous Features

Secondary considerations in connection with the realization of the two-motor automatic positioning drive include the provision of centrifugal fans on each of the motors (see Fig. 4). These fans exhaust into the burner base enclosure, from where the air is directed up through the rotating positive feed head, and against the negative feed head, thereby keeping these parts at low operating temperatures.

Immediately above and parallel to the negative carbon is located a jet tube which directes a stream of air at the arc tail flame immediately above the crater.

This device has several useful functions in that it shortens and redirects the tail flame away from the reflector, as shown in Fig. 5. The white ash product of combustion of the arc is blown away from the reflector, thereby eliminating deposit on the reflector and the consequent breakage caused by heat differentials.

Another benefit derived from the air jet is that it supplies enough additional air to the vicinity of the arc that upon striking the arc the soot particles are consumed instead of being released to the reflector surface, or lamphouse interior.

Finally, the air jet causes the blending of the negative and positive flames and results in excellent stabilization of the arc without the use of an auxiliary magnetic field. Thus, with the embodiment of the differential concept of carbon feed which was developed for the purpose of obtaining uniform feed in conjunction with automatic positioning of the positive crater, it is possible to stabilize the burning of the arc and keep the products of combustion from the lamphouse optical system.

Expand Cron-O-Matic Sales

The recent appointment of additional theater supply dealers for the new Cron-O-Matic carbon saver provides this unit with nation-wide distribution. This unit, which is adaptable to Ashcraft "D," Brenkert Enarc, Peerless Magnarc, and Strong Mogul arclamps, uses carbon stubs of all lengths, with no preparation required.

Steadily increasing interest in this device is believed to reflect, in part, the desire of theaters to conserve their supply of carbons which have the heavier copper coating. A brochure on this device is available from Payne Products Co., 2454 West Stadium Blvd., Ann Arbor, Mich.

Report on SMPTE 69th Convention

MEETING in an atmosphere charged with not a little uneasiness because of the troubled international situation and the requirements of the national defense program, the Society of Motion Picture & Television Engineers offered a varied program of papers and demonstrations at its recent 69th semi-annual convention at the Hotel Statler, New York City. Particularly concerned anent the critical materials situation were the equipment manufacturers and the film theater groups.

Nathan Golden, film division director for the NPA and principal opening day speaker, warned that diversion of essential materials for defense will be progressively greater in the months ahead. With respect to the effect of shortages on the civilian economy, he held out hope that defense orders "now totaling billions of dollars" would soon relieve the situation.

Scouting rumors to the contrary, Golden declared that there is at present no shortage of motion picture film.

Industry Ignores Technical Advances

Producers and exhibitors of motion pictures were urged by Peter Mole, Society president, to take advantage of existing technical advances which, he said, would help to maintain motion pictures as the greatest medium of mass education and entertainment.

"Technical contributions already at hand," said Mole, "are so far ahead of the industry's willingness to adopt them that the lack of interest may have the effect of applying a brake on future technical growth." These advances which are now available, he said, include not only television but also multiple sound tracks, wide-angle pictures, stereoscopy, and increased use of color.

NOTABLES AT SMPTE MEETING

Nat Golden, NPA official, who was the principal speaker on opening day, chats with Pete Mole, Society president.

The approach of producers and exhibitors to these technical advances, he concluded, must not be "What will it cost?" but "How can it benefit the industry?"

New Visual Presentation Form

The conventional indoor motion picture theater can re-establish itself as a unique medium of mass entertainment if exhibitors and producers of motion pictures will resume where they left off when sound was introduced more than twenty years ago, and adopt advanced techniques of visual presentation for which only the indoor theater has facilities. This was the advice of Ben Schlanger, noted theater architect.

By using larger screens and stereophonic sound, in conjunction with the development of more flexible screen cinematography, based on known factors of psycho-physical vision, Schlanger said, the familiar movie house can offer patrons a type of entertainment experience for which home television and drive-in theaters are not equipped.

Schlanger suggested the use of screens large enough to fill most of the patron's field of vision, giving him the illusion of participating in the scene instead of viewing it through a "window." The full width of the screen would be used for panoramic scenes, but during concentrated action in any one portion of the picture, detail and brightness in the rest of the screen area would be reduced, conforming to the experience of the eye in normal vision.

In viewing a "live" scene, Schlanger pointed out, we are aware of objects in a wide field of vision until some sound or motion concentrates our attention on a narrower field. We then observe detail only in the field of concentration, although we remain aware of light, shadow, and color in surrounding areas.

Schlanger declared that this type of presentation can be effected with existing studio and theater equipment.

'Synthetic' Vision of Future

Synthetic vision "almost as remarkable as natural vision" in its depth perception and other characteristics will be achieved in motion pictures and television, it was predicted by Major R. V. Bernier of the Wright-Patterson Air Force Base in Dayton, Ohio. Addressing a symposium on high-speed photography, Major Bernier described and demonstrated a new technique combining three-dimensional effects with full color and high-speed, normal-speed, and time-lapse photography.

In one novel scene in the demonstration film, a tray of refreshments appeared

(*Continued on page 24*)

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Oriental, Denver, Colo.
Dream, Kansas City, Mo.
Crest, Fresno, Calif.
Broadway, Charlotte, N. C.
B'Jou, Montreal, Que., Can.
Huntington, Huntington, Que., Can.

HOTELS
Statler, Washington, D. C.
Copley Plaza, Boston, Mass.
Palmer House, Chicago, Ill.

TV STUDIOS
WGN-TV, Chicago, Ill.

ARENAS
Hershey Arena, Hershey, Pa.
Hobart Sports Arena, Troy, Ohio
Chanute Air Force Base, Rantoul, Ill.
Sports Arena, Toledo, Ohio
Community Centre Ice Arena, Sudbury, Ont., Can.
Springfield Hockey Rink, W. Springfield, Mass.
Grand Rapids Stadium, Grand Rapids, Mich.

COLLEGES
Univ. of Denver Field House, Denver, Colo.
Univ. of Kentucky Coliseum, Lexington, Ky.
Rensselaer Polytechnic Inst., Troy, N. Y.

ICE SHOWS
Ice Vogues
Ice Capades
Holiday on Ice
Ice Cycles
Ice Parade
International Ice Review

LODGES
Masonic Temple, Hammond, Ind.
Medina Temple, Chicago, Ill.
Scottish Rite Temple, Dayton, Ohio
Zembo Shrine, Harrisburg, Pa.

INDUSTRIES
Anaconda Copper Mining Co., Anaconda, Mont.
Coca-Cola Bottling Co., Du Quoin, Ill.
Eastman Kodak Athletic Assn., Rochester, N. Y.
Pontiac Motor Div. Gen. Motors, Pontiac, Mich.

TRAVELING SHOWS
Gene Autry
Skating Vanities

AUDITORIUMS
Peabody Auditorium, Daytona Beach, Fla.
The Coliseum, Sioux Falls, S. D.
Corn Palace, Mitchell, S. D.
Milwaukee Auditorium, Milwaukee, Wis.
Civic Auditorium, Seattle, Wash.
Civic Auditorium, San Jose, Calif.
Municipal Auditorium, Ft. Lauderdale, Fla.
Lynn Memorial City Hall, Lynn, Mass.
Sioux City Auditorium, Sioux City, Ia.
Municipal Auditorium, Birmingham, Ala.
City Auditorium, Jackson, Miss.

Drawing only 10 amperes from any 110-volt A.C. convenience outlet, the Trouper makes the use of heavy rotating equipment unnecessary. With an adjustable, self-regulating transformer an integral part of the base, the Trouper is ideal for traveling shows. Mounted on casters it's easily portable and readily disassembled for shipping.

The high efficiencies of the Trouper are largely attained by the optical system which utilizes a silvered glass reflector and a two-element variable focal length lens system. The automatic arc control maintains a constant arc gap, free from hiss or flicker. A trim of carbons burns one hour and 20 minutes at 21 volts and 45 amperes.

THE NEW STRONG TROUPERETTE INCANDESCENT SPOTLIGHT

... for small theatres, schools, night clubs, TV studios and industrial shows; where physical dimensions and price are factors and where the tremendous light volume of an arc lamp is not necessary.

PROJECTS FAR MORE LIGHT THAN ANY CONVENTIONAL, INCANDESCENT SPOTLIGHT

This increased brilliancy is made possible by a variable focal length objective lens system, a 5¼-inch silvered glass reflector, and Fresnel lens used with a standard 115-volt, 1000-watt prefocused projection type bulb.

As contrasted to the conventional incandescent spotlight, with which the spot size is varied solely by irising, to result in substantial light loss, the Trouperette utilizes all the light through most of the spot sizes.

6½ TIMES BRIGHTER HEAD SPOTS

Sharp edges from head spot to flood. Horizontal masking control can be angled at 45 degrees in each direction. Fast-operating color boomerang accommodates six slides. Height-adjustable mounting stand.

Can be plugged into any 110-volt convenience outlet.

THE STRONG ELECTRIC CORPORATION
"The World's Largest Manufacturer of Projection Arc Lamps"
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Please send free literature on the ☐ Strong Trouperette Incandescent Spotlight; ☐ Strong Trouper Arc Spotlight.

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THE PROJECTIONIST'S

PROJECTOR

To the people out front enjoying a motion picture, you're the forgotten man. But you're the fellows who make these pictures possible, and you're the fellows who know *better projection pays!*

TO RELAX SEE A MOVIE.

MANUFACTURED BY INTERNATIONAL PROJECTOR CORPORATION • DISTRIBUTED BY NATIONAL THEATRE SUPPLY

The Magic of Color

By ROBERT A. MITCHELL

The first of a series of three articles on the "what," "why" and "how" of color.

THE projectionist is intimately concerned with color. The projection of natural-color films, the effect of extraneous sources of colored light upon the appearance of projected pictures, and the color schemes employed in stage and auditorim decoration are encountered by the projectionist almost daily. Then, too, the projectionist has a very understandable interest in the various methods of photographing and printing colored films.

Color is by no means the easiest thing in the world to understand; but the subject is made much simpler by completely ignoring controversial theories of color vision and abandoning the classical approach to its study. Moreover, it is absolutely necessary to employ different names for different colors, the same names for the same colors, and to specify *exactly* what is meant by red, orange, yellow, green, *etc.* Let's avoid the mistakes of the past.

The Visible Spectrum

To see colors in their greatest degree of purity we naturally turn to the *visible spectrum*, a band containing all of the wavelengths of light from 740 to 360 millimicrons (red to violet) spread out in order.

Figure 1 illustrates a "normal" spectrum, such as that produced when homogeneous white light is analyzed by means of a diffraction grating, a plate of polished metal ruled with from 10,000 to 20,000 fine lines to the inch. A glass prism also produces a spectrum, but the grating spectrum is better for our purpose because equal intervals along the varicolored band correspond to equal differences in wavelength. A prism spectrum stretches out the violet end of the band and contracts the red end.

The red of the spectrum, however, is a deep orange-red, not true red. True red—the "reddest red"—cannot be found anywhere in the spectrum!

This statement may seem very strange to anyone who has ever observed the brilliant spectrum colors. The color contrast between the two ends of the spectrum is so great, however, that the eye is deceived into seeing the orange-red as real red, and the violet as a pronounced purple. Cover up from view all of the spectrum except the red end (610 millimicrons to infrared), and it will be seen that spectrum red corresponds exactly to the dull red of a glowing cigarette.

Intensities of Hues

All of the spectrum "colors" from 610 millimicrons down to the limit of visibility are actually only different intensities of the *same hue*! It is a fact that dark orange-red looks redder than bright orange-red.

The distinctive name of spectrum red is *vermilion*.

Passing along the spectrum from vermilion toward violet, we find a narrow band of orange hues, a very narrow band of yellows, a broad band of greens, a band of blues of moderate extent, and beyond this a region containing violet-blues and violets.

True purple, the reddish purples, and the purplish reds, like true red, are missing from the spectrum. The spectrum, therefore, comprises only an incomplete collection of hues.

It is common knowledge that by mixing together paints of different colors, or colored lights, we get new colors—even colors which cannot be found in the spectrum. This fact, together with the knowledge that only a limited number of fundamental hues (*saturated* colors) are needed to produce *all* of the colors which the human eye can see, led to the theory that human vision distinguishes one color from another by the relative degrees of optical stimulation of a limited number of color-perceptive centers in the eye.

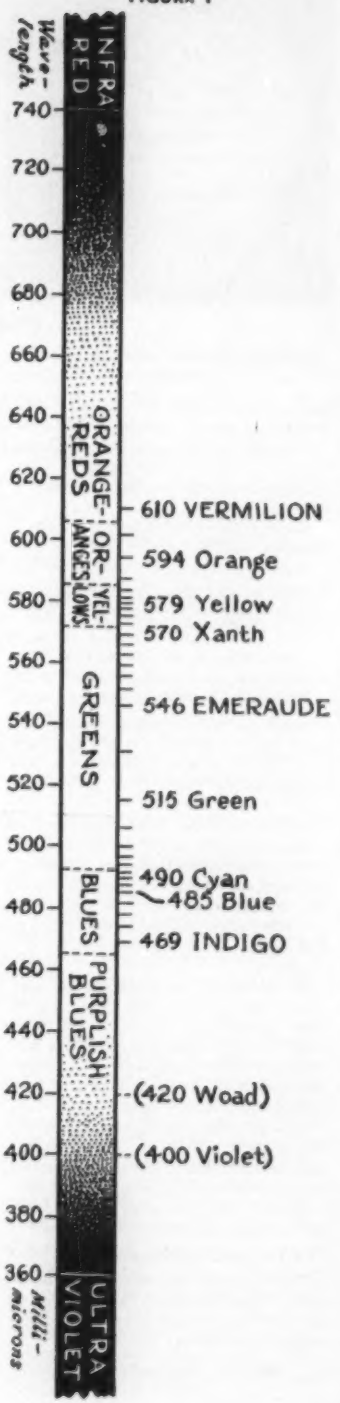
The pure hue which stimulates one color center, but not any of the others, is called a *primary* hue.

From this theory it follows that colors not primary colors produce their characteristic visual sensations by the combination of two or more primaries.

Basic Hues for Color Vision

This theory, which can be tested in various ways, is today an established fact. But how do we know how many primaries there are, or what colors they are? Experiments with colored lights demonstrate that all colors can be produced with a minimum of three pure hues in various combinations. There are thus

FIGURE 1



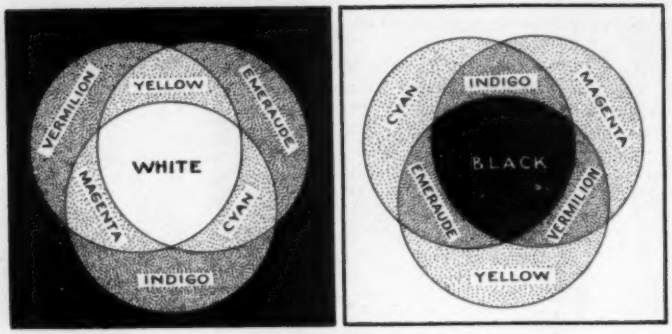


FIGURE 2

The *addition* of lights of the three primary colors. **The *subtraction* of primary colors from white light by filters.**

three primary colors. It has also been determined that the various colors are reproduced perfectly only when the primaries are such that no possible combination of any two of them will reproduce the third.

The three hues which have been established as fulfilling all the requirements of human *trichromatic* color vision are vermilion (610 to 740 millimicrons), emaraude (546 millimicrons), and indigo (469 millimicrons).

VERMILION is a deep orange-red
EMERAUDE is a slightly yellowish green
INDIGO is a deep violet-blue

These hues are commonly called "primary red," "primary green," and "primary blue," even though they do not correspond to "true" red, green, and blue.

If three lights are set up close together —one vermillion, one emaraude, and one indigo—any conceivable color can be reproduced on a white screen. If the relative intensities of the three lights are correctly balanced, the screen will appear *white* when all three lights are turned on.

By turning off the indigo light, a pure *yellow* light is seen—the combining of equal intensities of vermilion and emaraude. Vermilion and indigo make a purplish red called *magenta*; while emaraude and indigo together make a slightly greenish blue called *cyan*.

Because yellow is the opposite of indigo (yellow and indigo lights together make white), yellow and indigo are said to be *complementary* colors. Likewise, magenta is complementary to emeraude, and cyan is complementary to vermilion.

The Subtractive Primaries

Yellow, magenta, and cyan are sometimes called secondary colors. Artists and printers often refer to them as (subtractive) primaries.

YELLOW: Process yellow, Chrome yellow, "Minus indigo."
MAGENTA: Process red, Rose, "Minus emeraude."
CYAN: Process blue, Turquoise, Peacock, "Minus vermilion."

The left-hand panel of Fig. 2 shows the effect of combining circular spots of V, E, and I light in slightly displaced positions. Note that the three primaries superposed give white.

Similar, *but reversed*, color effects are obtained by superposing in displaced positions circular Y, M, and C color filters and viewing them against a clear field of white light. This is shown in the right-hand panel. Note that the three secondaries thus superposed give black. Fig. 2 therefore illustrates both *additive* and *subtractive* color formation. The latter is explained in terms of the three primary hues.

Take, for example, the formation of emaraude by combining yellow and cyan filters. The yellow filter subtracts I from white light and lets V and E pass. The cyan filter subtracts V, and lets E and I pass. When the yellow and cyan filters are overlapped, the cyan filter cuts off the V light passing through the yellow filter, and the yellow filter cuts off the I light which would otherwise pass through the cyan filter. Only E light gets through both of them, so the resulting color is emeraude.

Definition by Wavelength

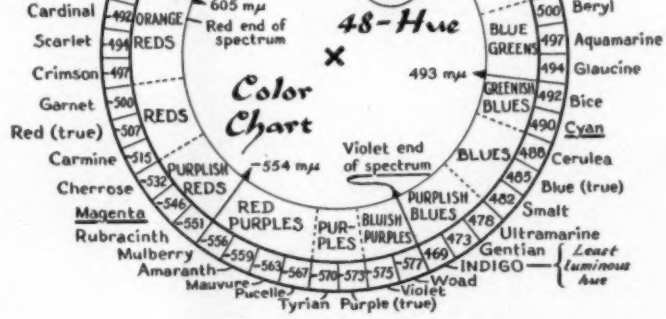
Most hues can be defined by their wavelength in the spectrum. Yellow, for example, has a wavelength measured as 579 millimicrons. Yet, as far as the human eye is concerned, an equalized mixture of vermilion (610) and emaraude (546) produces exactly the same color sensation as yellow (579). The two yellows which look alike, even though they have different spectral compositions, are called *metamers*.

Mixing vermilion and indigo lights in different proportions results in the production of *non-spectral* purples and reds. The non-spectral hues comprise about 36% of the total number of hues.

The "wavelength" of a non-spectral hue is usually designated as the negative wavelength of its complementary. Thus magenta, which has no real wavelength because it does not occur in the spectrum, is designated as —546 millimicrons, the negative value of the wavelength of emeraude, the complementary of magenta.

Wavelength, however, is not the most accurate definition of a hue. For example, the wavelength of cyan is 490 millicrons. But the cyan of the spectrum appears somewhat different *in the middle*

FIGURE 3



of the field of vision to *certain observers* from the cyan produced by combining emaraude and indigo. The disagreement of some observers on metameric color matches is due to the spectral-absorption characteristics of the "yellow spot" of the eye—the *macula lutea*.

A difficulty also arises in the case of hues more violet than indigo. It happens that the vermilion-sensitivity of the eye increases slightly in the spectral region beyond indigo, giving rise to such bluish purples as *woad* and *violet*. But observers seldom agree on the wavelengths which should be assigned to the hues lying between indigo and ultraviolet. For this reason both woad and violet are best regarded as non-spectral colors and assigned the wavelengths of —577 and —575, respectively. (The complementaries are *flavelle* 577 and *chartreuse* 575.)

We conclude that colors are best defined not by wavelength but by the proportions of primaries required to reproduce them.

Color-Induced Optical Illusions

There are two types of optical illusion produced by color. The most spectacular one depends upon the tendency of the eye to adjust its color sensitivity toward the complementary of the predominating hue in any colored object or light which is looked at for any length of time. This is sometimes called "color fatigue," sometimes "simultaneous contrast," depending upon the conditions which produce the illusion.

This peculiar property of the eye also makes colors appear the most vivid when placed in close proximity to their complementaries. Thus, pure blue looks bluer in close proximity to orange than when viewed by itself.

Place a red disk upon a sheet of white paper and gaze at the center of the colored disk for about half a minute. Then suddenly divert the gaze to a blank area on the white paper. A bluish green disc will gradually appear on the paper where there is no color! The red and bluish green are complementary colors. The same experiment may be tried with other hues. A bright yellow disk, for example, will create an apparitional blue-violet disk.

"Simultaneous contrast" is similar. A white movie screen surrounded by blue lighting, for instance, appears slightly orange, or yellowish. Incandescent light, decidedly yellow when compared with daylight, "whitens out" by virtue of increased blue-sensitivity as we become accustomed to it.

The 'Purkinje Effect'

The second color illusion involves a slight apparent, or "seeming," change in hue with differences in intensity. This is due to the "Purkinje effect."

Suppose you have two lamps, one with a green bulb and the other with a red bulb, and that both appear equally bright. If you were to add another green and red bulb to each lamp, you would logically expect to see the two lamps still equally bright. Actually, the red lamp will seem to be brighter than the green one.

The eye reacts differently to equal variations in the intensity of green and red.

Emeraude is *apparently* affected least by actual changes in intensity; vermilion the most; and indigo lies between the two.

How does the Purkinje principle affect the apparent hue of certain colors? Take the case of yellow, a combination of vermilion and emaraude light. Darken to a considerable degree some *true* yellow paint by adding neutral black paint to it. Instead of obtaining a yellowish brown, as might be expected, the resulting color will be a slightly greenish gray-brown. The vermilion component of the yellow decreases more rapidly than the emeraude (apparently) as the black is added, thus shifting the dominant hue from true yellow to faintly greenish yellow (flavelle or chartreuse).

Size, Luminosity, Surroundings

Most other alleged color illusions involve the relation between the apparent size of colored objects and the luminosity of the objects and their surroundings. These are not color illusions, strictly speaking, since they can also be produced in black-and-white. And still other so-called color illusions simply fail to work for most observers.

A *hue* may be defined as a *saturated* color, a color produced by one primary alone or by two primaries in various combinations—never three. This, of course, refers to mixtures of colored lights. When paints or dyes are mixed, the laws of subtractive color formation hold good, and the secondaries (yellow, magenta, and cyan) must be substituted for the primaries.

The eye is able to distinguish about 200 hues—for all practical purposes exactly 192. The various combinations of vermilion and emeraude number 63 distinguishable hues, of emeraude and indigo 55, of indigo and vermilion 71. Add to these the three primary hues used alone, and the total is 192.

Strange it seems that each bicolor "set" yields a different number of differentiable hues; but the Purkinje principle offers an explanation. Human vision is not equally sensitive to equal variations in the intensity of the three primaries. This fact must be taken into account whenever an attempt is made to devise "equitempered" hue scales—color charts which are based upon equal color differences from hue to hue.

Color Notation Systems

The very widely used, but archaic and unscientific, Munsell Colour Notation System ignores equal hue differences and certain other prime requisites of a perfect color system. Small wonder that practical color technology is in a state

(*Continued on page 29*)

Theater Equipment and NPA Regulations

AS A service to the manufacturers of motion picture theater equipment, no less than to the theaters themselves, IP desires to stress the appended points relative to National Production Authority regulations applicable to both new construction and the purchasing of various replacement units of equipment.

1. Equipment should be purchased NOW while reasonable delivery terms may be obtained.

2. There is no limit to the amount of money that an exhibitor may spend for most theater equipment.

3. The exhibitor needs no preference ratings for the purchase of equipment at the present time.

4. It is possible for a theater owner to obtain NPA permission to spend more than $5000 at one time on alteration and modernization of his theater by making application to NPA on Form F-24.

5. Acceleration of the defense effort will create shortages of material that will decrease the manufacture of theater equipment to a comparatively small percentage of normal supply.

NPA has published the most detailed list of various classifications of equipment, and it would be well if every theater in the country had this list on hand against the time when their needs develop.

IN THE SPOTLIGHT

By *HARRY SHERMAN*

MOST encouraging was the renewed interest in practical projection exhibited at the recent semi-annual convention of the SMPTE, held in N. Y. City. Not only was the papers programs generously lardered with projection topics, but there was the best representation of projection people we have seen at any SMPTE gathering in several years.

We have felt that for all too long the importance of projection has been lost sight of by the Society. The recent convention, plus the reorganization of the Projection Practice Committee under the chairmanship of a practical projectionist—M. D. O'Brien of Loew's Theaters—did much to dispel our mounting fears anent this situation.

It is to be hoped that these developments indicate that in the future the Society will continue to accord projection the attention it deserves.

• Michael J. Mungovan, business representative for Local 25, Rochester, N. Y., wound up a career of 53 years backstage when he resigned last month from his job as chief stagehand at Loew's Rochester Theater. He will now devote his full time to his numerous union activities. In recognition of his retirement from his job at the theater, all Rochester AF of L unions affiliated with the IATSE feted Mike at a midnight party held at Rund's Restaurant.

Louis Goler, member of Projectionists Local 253, acted as master of ceremonies. Special guests on hand were James L. Burke, president of Rochester AF of L; Julius Loos, secretary of the Allied Printing Trades Council, and other AF of L members associated with Mike during his half-century service to organized labor.

Mike is a vice-president of the New York State Federation of Labor; a member of New York District No. 10 executive board, and he belongs to many State Labor Department and AF of L organizations and committees.

• A plan to combat the raiding tactics of NABET, now affiliated with the CIO, was drafted recently by a committee of representatives of every AF of L union on the West Coast interested in radio and television. At the first meeting of this group, announcement was made of the overwhelming defeat of NABET by a vote of 10 to 0 in favor of the IATSE at radio station KFI-TV in Los Angeles. The AF of L committee will meet each week during the campaign to eliminate the CIO union from the radio and television studios. Carl G. Cooper, 7th vice-president, and Roy Brewer, special West Coast representative, are members of this committee representing the IA.

• The regular monthly meetings of the famous 25-30 Club are becoming more and more popular. Each meeting is highlighted by some special event—either an address by a prominent industry figure or a lecture and demonstration by a technical expert on the latest advances in the projection field.

Two new members were obligated at the April meeting of the Club—Harry E. Storin, vice-president of New York Local 306, and Arthur Raff, member of the Local. Among the "regulars" at the Club meetings are Admiral Tomkins and Arthur Meyer, of International Projector Corp., and Allen G. Smith, New York branch manager for National Theater Supply Co.

• Governor Paul A. Dever, of Massachusetts, reappointed Benjamin Hull, former president of Local 186, Springfield, Mass., as associate commissioner of labor. Despite heavy pressure brought to bear on the Governor to name a Democrat to replace Hull, a holdover from the former administration, he refused to yield and reappointed Hull for another term.

NEW SIMPLEX X-L'S FOR ROXY, N. Y.

Allen Smith, National Theater Supply manager, and Charles Tally, director of visual and sound projection, inspect installation of three new X-L projectors in this famous Broadway house.

• Our very good friend Herbert Aller, business representative of Cameraman's Local 659 (Hollywood), won a public speaking contest at the graduation exercises of the Industrial Relations Course at Loyola University in Los Angeles, Calif., and was awarded a medal for proficiency in oratory. Herb chose as his topic the defense of President Truman's action in removing Douglas MacArthur as supreme commander in the Far East

• H. N. Elliott, former secretary and long-time member of Toronto Local 173, and Frank Ford, member of Cleveland Local 160, were among the recent out-of-town visitors to the offices of IP.

• An attendance of about 200 celebrated the 35th anniversary party of Local 433, Rock Island, Ill., which was held May 3 at the AF of L's new Temple Club. In addition to the members of Local 433, representatives from many of the nearby IA Local Unions were present. Fred Parker, business representative of the Local, introduced the toastmaster of the evening—John H. De Young, secretary of the Tri-States Federation of Labor.

Among the guest speakers were Felix Snow, IA 6th vice-president; William Donnelly, IA representative and also business representative for Minneapolis Local 13, and Herbert D. Grove, district manager of the Tri-States Theater Corp. Grove, incidentally, is a charter member of the Rock Island Local, having been one of its organizers 35 years ago. Also present were Cliff Carney and W. E. Davis, president and vice-president, repectively, of the Tri-States Federation of Labor; Herb Weinberg, editor of the *Labor Review*, and Gabriel Gernaey, Federation board member.

• Roy M. Brewer, IA West Coast rep-

resentative, is chairman of a committee appointed by the Hollywood AF of L Film Council to draw up plans for the reopening of wage negotiations next October between the major producers and 14 IA Local Unions on the West Coast. An offer of 10c per hour increase for hourly workers and a flat $7 per week increase for straight salaried workers, contingent upon the Local's agreement to advance the existing IA contract from October 1951 to October 1952, was turned down by all the Locals involved.

• News of the accidental death by drowning of J. Max Ealy, for many years secretary and business representative of Local 378, Wichita Falls, Texas, came as a shock to his many friends in the Alliance. Max and his wife, together with several friends, were fishing in Lake Kickapoo, Texas, when their boat capsized and they were thrown into the water. All but one member of the fishing party were drowned. Max's body was not found until four days later.

• Personalities at the recent SMPTE meeting: RCA's Marty Bennett was easily the handsomest man present. . . . Pete Mole, president of the Society, won the hearts of all present at the dinner-dance by making the shortest welcoming address on record—less than one minute. . . . Ed Lachman (Lorraine Carbons) has won many friends for himself and his product by his gracious and amiable personality. . . . Bill Kunzmann, as usual, was here, there and everywhere, doing his level best to keep things running as smoothly as possible. Much of the success of the gathering may be attributed to his very capable and tireless behind-the-scenes efforts. . . . The projectionist craft was represented by Charlie Dentelbeck, Toronto Local 173; Jack Sawyer, Buffalo Local 233; Herman Gelber, Harry Storin, Ernie Lang, Hyman Boritz, John Krulish, Steve D'Inzillo, Harry Garfman, Harry Hollander, Wally Byrne, and Charley Mueller (Radio City Music Hall projection chief), all of New York Local 306. . . . Loren Ryder, past president of the Society, was very much in evidence greeting his many old friends. Loren is chief sound engineer at the Paramount Studios on the West Coast, and is highly regarded in the industry.

• Organized labor in the State of New York is very much concerned about the Hughes-Brees Bill, signed recently by Governor Thomas E. Dewey. In protest against the Governor's action, Frederick F. Umhey, executive secretary of the New York State Advisory Council on Placement and Unemployment Insurance since 1940, resigned from his post, charging that "since the only sponsors of this bill were the big business interests of this State, and since it was unanimously opposed by organized labor, you have, by signing this bill, aligned yourself with big business, who will be its chief beneficiaries. . . . It will do untold harm to the small businessmen of this State and to its working population. It has removed our unemployment insurance law from the category of social legislation. . . . We will, in a short time after the Hughes-Brees law goes into operation, face a complete breakdown of unemployment insurance in this State."

FLOYD M. BILLINGSLEY

Floyd M. Billingsley, third vice-president of the IATSE and business representative of Local 162, San Francisco, died on May 2 of surgical shock following an operation. He would have been 61 years of age on May 5, having spent 44 years in show business.

A native of Texas, Billingsley became associated with the first nickelodeon in Austin, Texas, in 1907, a few years following which he moved on to San Francisco, his home town ever since. He joined Local 162 in 1918, and was its business representative almost continuously since 1929. He was appointed an IA vice-president in 1931.

A delegate to the San Francisco Central Labor Council for the past 17 years, Billingsley served since 1947 on the World Trade Center Authority by appointment of Governor Warren of California.

• We learned that a collection of $50,000 for the Hill Rogers Memorial Hospital at Saranac Lake, N. Y., was made at the dinner tendered IA President Walsh last month by the film industry. It may not be generally known, but a great many of the patients at this hospital are IA members from all parts of the country, and the care and attention they receive, without any charge, cannot be improved upon even in the most expensive sanitoriums.

This is one organization that deserves the support of every theatrical union in the country.

• Organized labor in Ohio faces a new menace with the introduction recently of a bill called SB-213, which, according to the Ohio State Federation of Labor, out-Taft-Hartleys the T-H law. It is the contention of the State AF of L legal department that Section 5 of this proposed bill, which prohibits unions from denying membership except for failure to pay dues and initiation fees, might be called a "Magna Charta for communists." Many unions now refuse to accept communists as members, but under the SB-213 bill, refusal to admit them as members would subject unions to civil and criminal action.

Among the other obnoxious features of this bill is a provision outlawing all picketing, no matter how orderly and peaceful. The language of the bill is so broad that it can be interpreted as prohibiting any act or agreement which "tends to have the result" of establishing a union shop, closed shop, or hiring hall.

The sponsors of this bill imported Cecil B. DeMille, movie producer well known for his anti-union leanings, to the hearing accorded the proponents of this measure. DeMille gained nation-wide publicity when he gave up his radio show rather than submit to majority union rule.

Opponents to the SB-213 Bill will be heard at a later date, at which time we will report the final outcome of this proposal.

• Michael J. Ostrowski, veteran member of Local 233, Buffalo, N. Y., advised us of the marriage last month of his son Frank, also a member of the Local, to Amy Gawon, secretary to Dave Miller, of Universal Film Corp.

Photograph Interior of the Eye

A HIGH SPEED CAMERA for photographing the tell-tale interior of the eye is now in production. Developed after two years' research by Bausch & Lomb Optical Co., it photographs—in color or black-and-white—the retina, nerve fibers and other structural elements of microscopic size within the eye.

The only camera of its kind in production today, it was designed at the request of the U. S. Public Health Service for studies showing the relationship between enlarged retinal blood vessels and vascular diseases. The camera has also been used extensively by Dr. Walter Kempner, of Duke University Hospital, in his "rice diet" research and treatment of these diseases.

Photographs taken periodically of the interior of the eye are superimposed so that the blood vessels may be compared at various stages of treatment.

Theater Television

via the RCA PT-100 Equipment

By TECHNICAL PRODUCTS DIVISION, RCA SERVICE CO., INC.

VI. Interpretation of Image Characteristics

IN PART FIVE of this series of articles on the RCA PT-100 Theater TV Equipment, the location, function, and normal settings of the operating controls were discussed. In addition, it is desirable for the projectionist to have sufficient knowledge of the capabilities of the equipment to enable him to take corrective action and adjust the equipment controls to obtain best performance.

One of the most common causes of image degradation, when broadcast Tv signals are used, is interference pickup from the ignition systems of automobiles, buses and trucks. Street cars, sign flashers, diathermy, X-ray equipment and similar devices often radiate interference which may cause horizontal streaks across the screen. In such cases, all that can be done to the equipment at the theatre is to be sure that the receiver is properly tuned and the Tv receiving antenna is in the correct rotational position.

Signals transmitted by microwave relay link and coaxial cable are usually free from this type of interference.

Special Test Pattern Used

Where signal interference is present, or where a proper Tv signal is not being received, adjusting the controls of the PT-100 equipment cannot produce a normal picture.

Other causes of a technical nature may produce picture degradation. Any outstanding defects will be plainly seen in the projected picture. However, when critically analyzing the screen image it becomes desirable to use a special kind of picture which is designed to indicate the band width of the received signal, the resolution of the picture, and the correct adjustments of the operating controls. Such a special picture is called a test pattern.

Several different kinds of test patterns are commonly used. A typical test pattern is shown in Fig. 1. This test pattern consists of two large concentric circles with diameters in the ratio of 4 to 3. These are used for checking the adjustments of the height and width controls. When these controls have been properly adjusted, the outer circle will just touch the right and left sides of the screen, and the inner circle will just touch the top and bottom of the screen.

Interpreting Test Pattern

At the center of the test pattern there is a small black circle surrounded by four narrow concentric rings. These are used to check the settings of the video and black level controls. When the black level control is properly set, the inner circle will be solid black, and the inner concentric ring, which surrounds it, will be somewhat lighter.

When the video control is properly set, the outer of the four concentric rings will be white and the ring just inside it will be somewhat darker. Thus, the inner circle will be black, and the rings surrounding it will successively be lighter until the outer ring is reached; this will be pure white.

If the black level control is set too low, the center black circle will have a grayish color instead of solid black. If the black level control is set too high, the inner concentric ring will be black, as well as the center circle. If the video control is set too low, the outer concentric circle will be gray instead of white. If the video control is set too high, the outer two concentric circles will both be white.

If the video control is set too high, a condition known as "blooming" may occur in the projected image. When this occurs, the white parts of the picture will tend to spread out over the adjoining black parts, causing loss of detail and also lack of proper contrast between black and white. This resembles the well known "halation" caused by excess light on parts of a motion picture film. Ordinarily this condition will not be visible on the monitor kinescope.

Horizontal Image 'Tear Out'

Improper setting of the HOR. HOLD control will cause the picture to "tear out" horizontally. When this occurs, all or part of the picture will travel rapidly across the screen, producing a blurred jumble of picture elements. Resetting the control will correct this condition, provided the incoming signal is normal.

Also, the test pattern shown in Fig. 1 includes two pairs of wedges. Each wedge consists of a set of tapering lines extending inwardly from the large black circle to the concentric ring pattern in the center.

As these lines approach the center, they gradually become thinner and closer together. Obviously, the detail near the center ends of the wedges is finer than the detail at the outer ends, therefore these wedges will indicate the resolution of the picture.

The horizontal wedges indicate the vertical resolution, which depends on the number of scanning lines used by the Tv system. The present American scanning system uses 525 lines, which is more than adequate to reproduce the fine detail at the inner ends of the horizontal wedges.

The vertical wedges indicate the hori-

FIGURE 1

A typical Tv test pattern put on the air by the broadcast station for checking band width of the signal, picture resolution, and correct adjustment of controls.

zontal resolution, which depends on the band width of the television signal. The standard Tv broadcast band width is 6 megacycles, which is more than adequate to reproduce the fine detail at the inner ends of the vertical wedges.

The RCA PT-100 theater Tv equipment is capable of accepting and using a signal having a bandwidth of 8 megacycles. When interpreting the test pattern which has just been described, it must be remembered that because of technical limitations many present-day video signals have a bandwidth of only 2 to 4 megacycles. When such a signal is used, the inner ends of the vertical wedges will be blurred. If a video picture signal with a bandwidth of only 2 to 4 megacycles is being reproduced, the finer details are lost.

Electron Beam Cutoff

It is very important that the electron beam in the kinescope can be turned on, or cut off very rapidly, by the incoming video signal, in order to produce sharp vertical edges on images of such objects as buildings, chimneys, *etc.*

To determine the speed of this control, two vertical edges are provided in the test pattern. These can be seen at the extreme right and left ends of the pattern, between the two outer circles, beyond the ends of the two horizontal wedges, as a pair of blocks. One of these is black, and the adjoining one is white.

At the left of the picture, the electron beam traverses the black block and then the white one. If the electron beam cannot be turned on rapidly enough, the black edge of the block, at the left of the pattern, will extend out into the white block, causing blurring of the black edge.

At the right of the pattern, the electron beam traverses the white block, then the adjoining black one. If the electron beam cannot be turned off rapidly enough, the white edge of the block at the right of the pattern will extend out into the black block, causing blurring of the white edge.

To visualize just how rapidly the electron beam must be turned on or cut off by the video signal, remember that the scanning spot travels across the picture once, and returns to its starting point, 15,750 times each second. Its travel across the screen occurs in approximately 55 *millionths* of a second!

Scanning Image Speed

On a screen 20 feet wide, the scanning spot image will travel one foot in 55/20, or 2.75, millionths of a second (2.75 micro-seconds). This is a speed of 1,000,000/2.75, or 363,636, feet per second; or 363,636/5280=68.8 miles per second, which equals 247,680 miles per hour. At this speed the spot could go once around the world in six minutes, or from New York to San Francisco in about 45 seconds!

As was stated in an earlier article, of this series, the RCA PT-100 Tv equipment will reproduce picture elements at the rate of eight million per second, or eight per micro-second. Each picture element may cut off or turn on the electron beam in the projector kinescope. As the spot image is travelling at the rate of one foot in 2.75 micro-seconds, and each picture element occurs in one-eighth of a micro-second, the beam can be turned on or off 8 x 2.75, or twenty-two times, in one foot of its travel across the screen. This is approximately *one-half inch* for each picture element, truly a terrific speed!

Obviously, all internal circuit adjustments must be properly made with the use of accurate test equipment—"rule-of-thumb" adjustments are entirely inadequate and would serve only to cause trouble. However, once the equipment has been properly installed and adjusted, and provided with a good input signal, it is capable of producing and projecting on the theater screen a sharp and acceptable picture of an event which may be taking place a thousand miles away.

[The End]

Roundup of Operation, Maintenance Data

These excerpts from a booklet relative to the operation and maintenance of the Peerless Magnarc H-I arclamp introduce a series of similar articles culled from instruction booklets issued by various projection equipment manufacturers. The complete Peerless booklets are available free upon request to the manufacturer.*

I. The Peerless Magnarc H-I Arclamp

IN SETTING up the lamphouse on the projector pedestal, it is important that it be clamped firmly by means of the screws that pass through the pedestal table. The screws which retain the door to the lamphouse rear casting may be discarded, as they are used only for shipping purposes.

The lamphouse door should not be opened until the lamphouse is securely fastened to the projector table, as its weight may cause the lamphouse to overbalance.

All electrical connections between the main terminal block and the carbon holders, *etc.*, are made at the factory. It is necessary, therefore, only to connect the main terminals to the current supply circuit, and that the supply leads for the Trim Alarm be connected to a 6-volt A. C. source. Higher than 6-volts will shorten the life of the lamp bulbs as well as the colored plastic domes that cover them.

For the pilot light inside the lamphouse, one need only enclose the leads in a length of flexible conduit and connect them to a current supply; this supply may often be found at the projector motor switch or at some convenient 110-volt outlet.

Power Supply Requisites

The Peerless Magnarc may be operated with any multiple-type motor generator, or a 110-volt D. C. service, or with a rectifier, providing that the current capacity of the supply unit is sufficient for the current rating of the carbons to be used. Low-voltage motor generators and rectifiers having satisfactory outputs are available for use with this arc. These lamps may also be operated from higher voltage generators if proper ballast rheostats are inserted in the circuit to reduce the generator output to that required at the arc.

The current range of the Magnarc, together with proper carbon combinations, are shown in Table A. After installation, however, if it be found desirable to change the original carbon sizes to use more or less current, the job may be accomplished very quickly right in the projection room by simply changing two gears as illustrated in detail by drawings in the Magnarc bulletin.

Correct Optical Alignment

Of critical importance in the operation of any arc lamp is correct optical alignment. For this purpose Magnarc makes available rods and discs which, together with a dummy lens barrel, insure practically perfect alignment. The operating distance from the rear surface of the reflector, when measured through the hole in its center, to the projector aperture should be approximately 34 inches.

To obtain this dimension, it may be necessary on certain projectors, using rear shutters, to remove and discard the small metal light cones mounted on the rear half of the rear shutter housing.

When a Magnarc installation is made on projectors having certain types of rear shutters, it will be found that approximately 35½ inches is the shortest working distance that can be obtained

(*Continued on next page, Col.* 1)

* J. E. McAuley Mfg. Co., 314 West Adams St., Chicago 6, Ill.

COPPER-COATED H-I CARBONS	AMPERAGE RANGE	ARC VOLTAGE RANGE
7-mm. Positive / 6-mm. Negative (Orotip "C")	40-42	27-28
7-mm. Positive / 6-mm. Negative	42-50	33-37
8-mm. Positive / 7-mm. Negative	60-70	36-40

TABLE A

Carbon combinations, arc voltages and amperages, as compiled by National Carbon Company.

between the reflector vertex and the projector aperture. This is due to the added space that must be provided between the lamphouse front and the rear shutter assembly to allow for the opening of the film gate for threading.

Conventional disc-type rear shutters and their housing generally permit free passage of a cone of light having a circular included angle of 30 2/3 degrees, beginning at an apex point on the optical axis line that is 1 3/32 inches beyond the aperture.

Caution Against Excessive Draught

The Magnarc operates at relatively low arc voltage, and precautions should be taken to guard against air drafts which will disturb the arc. If forced draft is employed in the vent pipes to carry off arc gases, the chimney damper should be installed in the exhaust piping just above the lamphouse chimney base to permit draught regulation to a point where no arc disturbance occurs.

An adjustable friction clutch is provided for the negative carbon feed clutches. The tension of it may be increased or decreased by tightening or loosening the large nut located on the extreme left end of the negative feed clutch shaft. This nut is locked in position by a small set screw. Upon loosening this set screw, the nut may be screwed in or out to tighten or loosen the friction clutch until the desired degree of feeding tension is had.

For ease in rapid arc striking, the tension should not be excessive—only sufficient to insure accurate feed of the negative carbon.

Sudden Current Increase

At infrequent intervals during normal operations a relatively sudden increase of current may register on the ammeter. Generally, the cause can be traced to small cracks in the shell of the positive carbon or to overloading the carbon combination used. When such cracks occur, they permit a leakage of gas from the crater, rarefying the gas, which condition in turn reduces the normal resistance across the arc.

During such periods the crater will become very shallow and the rim of it will burn to a pronounced rounded edge. The only remedy is to allow the cracked area of the carbon to burn away, or to retrim at the first opportunity.

A good grade of lubricating oil, similar to that used for projectors, should be used on the Magnarc. Oil should be used sparingly, since all parts of the Magnarc are slow-moving, requiring only a few drops of oil in each oil cup—once a week should suffice.

Do *not* use graphite, or any lubricant containing graphite, on a Magnarc lamp.

A Microfilm Edition of IP

All or any part of any issue of IP since Jan., 1950 and in the future is now available on microfilm to libraries, industry and other interested parties as a result of negotiations completed with University Microfilms, 313 No. First St., Ann Arbor, Mich. Complete details relative to this microfilm service is available from the aforementioned organization.

British Projection Plagued by Excessive Print Damage

MOTION picture projection is the same the world over, but the British Isles would seem to be having more than a little trouble anent the mutilation of film prints, of a character which has not been too obvious in the U. S., except for the war years, for many a day. As usual, there is the inevitable buck-passing between projectionists and distributors, with the latter following the familiar pattern of being excessively vague as to their inspection routine, *etc.*

R. H. Cricks, editor of the technical section of the *Ideal Kinema* (London) reports as follows:

"Scratching represents 50% of all damage reported, and perforation damage another 33%. The comparatively small remaining proportion of faults were classified under 19 different headings. Every case of damage was attributed by the renter's (distributor) print manager —necessarily with some degree of uncertainty—to some particular fault.

"Various aspects of projector adjustment or maintenance represented 35%, excluding the classification of 'run off sprockets' (probably also a projector or a reel fault), representing another 9.9%. Dirt or emulsion in the gate represented 18.7% of the faults.

"Faulty threading accounted for 15.3%, and various rewinding faults 17.3%. One figure which I frankly question is 'lack of wax'—0.3%; I should have expected a far higher figure.

'Accidental' and 'Deliberate'?

"With the finest of equipment and the most skilled projectionists, an occasional mishap is bound to occur, yet the figure for 'accidental' was only 0.5%—the same as for a rather unpleasant heading of 'deliberate'. A wide variety of causes accounted for the remaining 2½%.

"One thing is very clear from these figures: nearly two-thirds of all film damage is, in the opinion of the renter's examiners, caused by projectors in faulty condition. The moral is obvious."

It would seem also that British projection equipment is either pretty aged or in a sad state of disrepair.

Importance of DO-97 Stressed by National Theatre Supply

The importance of the new Regulation 4 recently issued by the National Production Authority to authorize the use of a priority rating for business establishments to obtain necessary maintenance, repair and operating supplies is being called to the attention of customers by National Theatre Supply. This rating, known as DO-97, places on a supplier or manufacturer receiving it the obligation to fill such rated orders ahead of non-rated orders.

To alert exhibitors, who may still be unaware of its importance and to make it convenient for them to extend the rating to the supplier, National has prepared a handy yellow-and-black sticker which can be signed and attached to the order. The sticker reads as follows:

NATIONAL THEATRE SUPPLY

"DO-97. Certified under Regulation 4."

SIGNED .....

A quantity of these stickers are sent to all customers together with a printed notice pointing out that their use in securing and forwarding the DO-97 certification will eliminate delays and assists manufacturers in continuing to obtain essential raw materials, thus insuring an adequate supply of operating requirements.

Eastman Kodak Earnings Top '50

Eastman Kodak Co. has announced preliminary consolidated sales of approximately $113 million for the first quarter of 1951 (12 weeks ending March 25). This compares with reported sales of approximately $84½ million for the corresponding period in 1950. Sales so far this year have continued the upward trend that developed in the last half of 1950.

H-I Carbon-Arc Spotlights Enjoying a New Vogue

Dimensional characteristics of H-I spotlight under various operating conditions.

THE greatly increased number of large arenas in the U. S. and Canada within the past few years has revived widespread interest in the art of spotlighting—for an art it is. Seating from 6,000 to 12,000 these arenas offer hockey, basketball, boxing, ice shows and many other attractions.

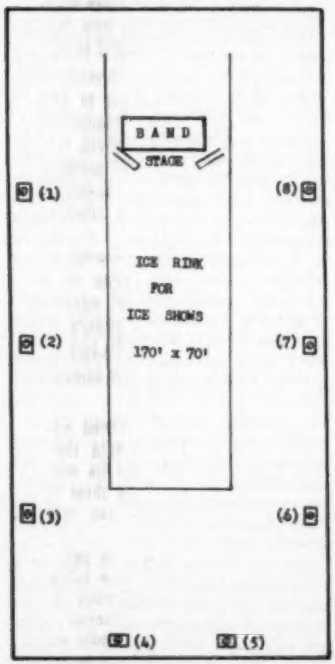
Exacting Requirements

Lighting the performers in an ice show is a prime example of the exacting requirements for efficient spotlighting. Here is a soloist moving around a rink 200 x 70 feet, with 12,000 pairs of eyes focused upon him and following his every move. The whole arena is in semi-darkness (similar to the light level of a modern movie house) and only the powerful spots cast their beams on the skater.

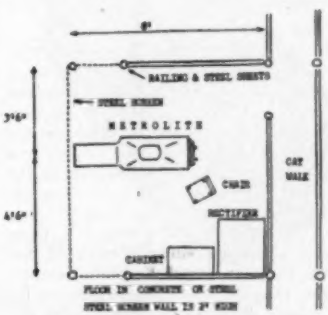
Under such circumstances, 8 to 14 modern spots are used, located in cages all around the arena about 30 to 50 feet above the rink. Not infrequently the tilt of the unit approaches 70 degrees, at which time the performer comes almost directly underneath the light beam.

The operators of such spotlights are more than a little busy during an ice show. There is a master light plot, of course, but changes are constantly being telephoned by the lighting director. These instructions must be carried out instantly, especially when they have to "hit" or blackout a performer.

They must also follow the intricate, sometimes unpredictable, movements of the skater; they must change the diameter of the spot from a small concentrated headspot to a flood covering a large area of the rink; they must change the color gelatins, of which they have an extensive supply, and they must utilize with judgment the fading iris.



General arrangement for the use of 8 H-I carbon-arc spotlights in an arena.



Typical spotlight operating enclosure.

Performance Depends Upon Design

All these requisites must be considered by the manufacturer of the spot. Easy and quick manipulation, plus a perfectly reliable arc mechanism, are cited as the prime requisites by Genarco, Inc., makers of the Metro-Lite high-intensity, carbon-arc spots. Genarco makes two H-I spots: the Model ME-4 which pulls 125 amps D.C. and has a range of throw of from 100 to 400 feet, and the Model ME-5, the vaudeville-type, which pulls 60-85 amps D.C. and covers the 75 to 250 ft. range of throw.

Genarco is an ardent proponent of H-I carbon-arc spots because of the tremendous flood of light that can be placed on an arena. For example, when a performer is in the center of an arena, the throw from 4 of, say, 8 spots would be 100 feet, and the throw of the other 4 spots would be 200 feet. The illumination from a Metro-Lite spot 8 feet in diameter would be 400 foot-candles; the same spot at 100-feet throw would give 100 foot-candles.

Detailed information on the Metro-Lite spotlights is available from Genarco at 36-56 34th St., Long Island City 6, New York.

IA ELECTIONS

LOCAL 162, SAN FRANCISCO, CALIF.

John A. Forde, *pres.*; Orville G. Roush, *1st vice-pres.*; Robert M .Wilson, *2nd vice-pres.*; Raymond Kirkpatrick, *3rd vice-pres.*; Wm. Van Ornum, *4th vice-pres.*; Ernest Langley, *5th vice-pres.*; Thomas J. Kearney, *sec.-treas.*; Floyd M. Billingsley, *bus. rep.*; Antone J. Salemi, *sgt.-at-arms*; Roush, Wilson, Kirkpatrick, Van Ornum, and Langley, *exec. board.* (Floyd Billingsley died shortly after election to office.)

LOCAL 165, HOLLYWOOD, CALIF.

Edward Egan, *pres.*; Leo Moore, *vice-pres.*; Howard Edgar, *sec.-treas.*; George Flaherty, *bus. rep.*; Al Pullen, Harold Masser, Frank Chaney, Ed Wirling, J. Higgins, *exec. board*; William Hunger, William Harris, John Linahan, *trustees*; Harold Swanson, Pat Offer, John Schwartz, *exam. board*; Frank Chaney, E. Egan, L. Moore, G. Flaherty, *del. to CLU*; G. Flaherty, *del. Calif. State Fed. of Labor.*

LOCAL 277, BRIDGEPORT, CONN.

Roland J. McLeod, *pres.*; Frank Toth, *vice-pres.*; Thomas E. Colwell, *rec.-sec.*; Leroy Nickerson, *fin.-sec.*; Fred Lewis, *treas.*; John A. Martin, *bus. rep.*; John C. Lynch, *sgt.-at-arms*; John Benard, Joseph Cossette, Frank Gorman, Harold Ryckman, *exec. board*; Leslie C. Blakeslee, James Liburdi, William Towle, Mario Parrelli, Joseph Kaplan, *trustees*; Joseph Cink, James Leverone, McLeod, Nickerson, Benard, *del. CLU*; McLeod and Martin, *del. to all conventions.*

LOCAL 433, ROCK ISLAND, ILL.

Charles C. Derr, *pres.*; Mark M. Maston, *vice-pres.*; Warren Castle, *fin.-sec.*; Lloyd Burrs, *treas.*; Fred Parker, *rec.-sec.* & *bus. rep.*; Edward Short, *exec. board.*

Your Very Best Buy
BUY U. S. SAVINGS BONDS

THEATER Tv got its biggest shot in the arm since its inception during the past month in three developments which indicate that after months of fumbling the motion picture exhibition field finally recognizes the need for drastic action if the economic structure of the industry as presently constituted is to be preserved. These developments, not necessarily in their order of importance, were:

RCA announced that, in addition to the installations already made, new orders for 50 theater Tv systems had been received from 13 exhibitors in states ranging from coast to coast. Work on these jobs will begin immediately.

One of these orders was for 20 units from United Paramount Theaters, which already has five Tv houses. The import of this order lies in the willingness of an *experienced* operator in theater Tv to plunge so heavily on an extension of its Tv chain.

Wonder of wonders, the Theater Owners of America voted to raise a "war chest" to wage the fight for theater Tv allocations.

The FCC has set Sept. 17 next for hearings looking toward the allocation of frequencies and the promulgation of rules and regulations for theater Tv service. Fifty parties have filed petitions asking FCC to set aside frequencies for this purpose.

The National Collegiate Athletic Assoc. reaffirmed its intention to ban the televising of member college football games for home Tv in favor of cooperation with theater Tv.

200 Tv Theaters This Year?

RCA foresees the early installation of theater Tv equipment in at least 200 locations. There seems to be no doubt that the foresight of RCA in going ahead with full-scale production, even without definite purchase commitments, will permit the delivery of these units despite the growing shortage of certain critical materials which go into their manufacture. Also, the recent reduction in price of almost $10,000 to the present level of $15,800 will revive exhibitor interest in the equipment.

The IATSE already has a fairly strong grip on the theater Tv labor setup by reason of its members who have been operating such equipment for several years now, and also because of the joint RCA-IA efforts to instruct a group of leading projectionists representative of every geographical area in the country.

* * *

Thus the pattern on the exhibition side. But the production unionists were not idle either. Roy Brewer, IA representative on the West Coast, announced that the 14 IA Locals concerned with picture-making will demand participation in producer profits from pictures sold or leased to Tv of from 5 to 10%. This move adheres to the pattern of the musicians (AF of M), who have already inked such deals with film producers.

Already the three "talent" guilds—writers, actors and directors—have earned serious consideration from the producers for their demand of 35% of the Tv revenue from pictures made for the theater, the division of monies to be made on the basis of 1/3 each way. The AF of M deal provided for a 5% cut of such revenue, to go into a welfare find, *in addition to* the proviso that the musical track of each film had to be rescored by the same number of musicians originally employed and taking the same time it took to do the job originally. Obviously, this is purely and simply a make-work arrangement.

Sale of Tv Prints

Meanwhile, United Paramount Theaters is missing no bets with its intermediate Tv system, which takes programs off the air and records them on film. Events of prime national importance are rushed into print form and sold to *both* theaters and Tv stations. Reportedly, the recent MacArthur speech before Congress was leased for $1000 per print.

There is no doubt in informed circles that a circuit of Tv theaters could give the Tv broadcasters plenty of headaches. For example, last Fall the cost to the Univ. of Michigan for camera crews and the announcer for one game ran to $882. With 10 Tv theaters joining in a circuit for the same game, the cost would be only $88. And how about the profit angle?

Yea, verily, the theater Tv pot is boiling, and it would seem that the extent to which the chicken will be cooked to a point where it is edible would depend entirely on the courage, energy and resourcefulness of the exhibition field over the next few months.

* * *

Kinescope Recording a 'Must'

Kinescope recording "has withstood the test of time and trial by ordeal" to the point where "it may now don long pants and take its place beside its big brother, film distribution, to render a real service on a practical businesslike basis." So reported Frank C. Lepore, of NBC, at the recent SMPTE convention.

Lepore said that "kinescope recordings make possible national Tv networks guaranteeing a bright future for the newest and most dynamic medium of advertising and communication yet devised by man."

It was contended by Lepore that "despite all the gloomy talk about the extinction of kinescope recording when all stations have been interconnected by cable sometime in the future, the difference in time zones and delayed broadcasting three or four hours after the live show for the benefit of audiences in far places will continue to make kinescope recording or some modification of same a practical reality for some time to come."

* * *

Tv Socks Its Maw—Radio

Not all the woes passed along by the mushroom growth of television have been visited upon the motion picture industry. Radio, which spawned Tv, now finds itself a victim of its own *enfant terrible.*

N.B.C. is planning a reduction of its network radio time charges to meet a similar competitive move announced recently by C.B.S. The latter chain, the first among the four major radio networks to announce a cut, said its reduction of 10 to 15% would become effective on July 1.

The rate cutting, it is believed, comes as a result of inroads made on radio audiences by Tv. National advertisers, representing most all of radio's major sponsors, have sought a radio-rate reduction ever since Tv came into competition with the older medium.

While A.B.C. has announced no rate reductions, a spokesman said that the chain intends to "maintain its competitive rate advantage" among three of the major networks. Mutual has reserved comment so far.

The rate cut by N.B.C. is part of a three-way economy move now being formulated, including a reduction in the number of staff radio personnel. It is understood that all N.B.C. radio departments will be affected, but the number of personnel dismissed is not known.

In the case of sustaining radio pro-

grams, which have no sponsors, N.B.C. is planning less costly shows for next fall. What radio budget cuts might come before then cannot be foreseen.

NEWS PROJECTIONS

WAGE STABILIZATION BOARD has announced that motion picture "talent" will not be held to the 10% limitation on wage increases. Affected are players, producers, directors, writers, composers, musicians, art directors, wardrobe designers, cameramen and assistants, sound engineers, and film editors. . . . A flat per-admission rental charge for films for competitive theaters is advocated by Allied exhibitors. . . . Terrific print shortage, with film being "run to death" in successive engagements without proper exchange inspection, is attributed to distributor economy move rather than to any stock shortage. . . . Group of Tv film producers assert that video will be purchasing $240 million worth of film *annually* by 1954. . . . All-out use of color film, nothing less than 100%, is the "salvation of the motion picture industry." Who said it? Why, Dr. H. T. Kalmus, president of Technicolor.

- - -

Growing suspicion in film circles that surveys made by advertising agencies and other groups purporting to show the "decline" of motion picture interest are "plants" in behalf of their big-time Tv clients. . . . General Federation of Women's Clubs estimates that there are no less than 12 "good" films worth seeing each month. . . . Princess Theater, Minneapolis, offers 3 wrestling bouts and a feature film at $1 for adults and 50c for children. First such shows O.K. at box-office. . . . "Arty" films, mostly foreign-made, going great guns at "class" small theaters. . . . Tv programs continue to smear movies—in theaters, that is, because Tv would die without film, even of the 10-to-15-year vintage. . . . RKO Theaters in N. Y. City have renewed contract with NBC for the advertising of their film programs.

- - -

Bingo games, a tough competitor for theaters, is having a bit of rough going because of rising sentiment against any form of "gambling." . . . Paramount's releases for the balance of this year represent a record investment in production. . . . First-quarter craft labor employment in West Coast studios this year was 14,400, a gain of 1700 over same period last year. . . . Miami crusador's attempt to have all film theaters closed on Sundays flopped, the decision being that the exhibitor is not a "merchant." . . . Some exhibitors advocating a lower mid-week admission price as a spur to attendance.

Clear Crisp Pictures with
SUPER SNAPLITE
f/1.9
PROJECTION LENSES

Your patrons will notice the difference! Super Snaplites give you Sharper Pictures, More Illumination, Greater Contrast and Definition.

For the Best in Projection use Super Snaplites . . . the only Projection Lenses to give you a true speed of f/1.9 in every focal length up to 7 inches.

Ask for Bulletins 207 and 209

KOLLMORGEN *Optical* **CORPORATION**
2 Franklin Avenue
Brooklyn 11, New York

"YOU GET MORE LIGHT WITH SUPER SNAPLITE"

SMPTE 69th CONVENTION

(*Continued from page* 10)

to leave the hands of a serving maid on the screen and float out before the audience to a position just a few inches before the eyes of each spectator.

The stereoscopic effects are achieved, first by filming the scene from two different displaced positions, corresponding to the displacement of the eyes; next by projecting the film through a polaroid filter which polarizes alternate still pictures in different directions; and finally by viewing the pictures through polaroid viewing glasses, with a different polarization for each lens corresponding to that of the alternate frames of the picture.

Screen Brightness Sub-Standard

Screen brightness lower than the recommended standards was found in nearly one-fourth of 88 indoor theaters covered by a progress report presented by the Screen Brightness Committee.

Constituting findings to date in a survey of 100 representative indoor theaters begun by the committee last year, they reported that screen brightness ranged from 3.4 to 53 foot-lambers, with approximately one-fourth below and one-half within the ASA range. Two theaters equipped with highly-directional "silver" screens had a central maximum screen brightness in the range of 30 to 53 foot-lamberts.

With respect to distribution of illumination over the screen, expressed as a ratio of side-to-center intensity of incidental illumination, the committee reported that the side distribution ranged from 40 to 94% for the indoor theaters, with almost two-thirds of the projectors falling between 60 and 80%.

Poor Over-All Average

Only about 40% of the indoor theaters had reflectivities in the 70-to-80-per cent range typical of the matte white screen in good condition, the report stated. About 25% of the screens were a little below this range, and another 20% were substantially lower, ranging down to 44%.

"It is expected," the report concluded, "that the results of the survey, when completed, will form the basis of a Committee recommendation for improvement of projection practice in theaters." In the meantime, it stated, better attention to operation and maintenance could reduce the wide range of screen brightness and eliminate many of the highly non-uniform distributions of illumination.

Theater Tv Safety Program

Special safety regulations covering the installation and operation of theater television systems are being discussed in Chicago by the city's Board of Examiners of Motion Picture Machine Operators the Society was told by Samuel R. Todd, a member of the board. Such regulations, if and when adopted, will be administered by the same board, which has jurisdiction over all motion picture projector operation in the city, including such activities in television studios as well as in theaters, Mr. Todd said.

Although new problems, apart from those involved in film presentation, have been presented by the introduction of theater television, he said, presently available direct projection theater television equipment is "very well designed from the viewpoint of having adequate safety disconnect switches at all points where dangerous electrical potentials may be encountered."

Keep Safety Circuits Intact

It is extremely important, he said, that all of these safety circuits be kept intact at all times, and that no unauthorized modifications be made.

In the case of theater television systems of the so-called storage type, employing motion picture film, he said, a

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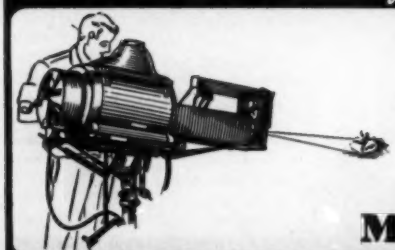

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properly ventilated room with fireproof construction is required for the television receiver, the 35-mm camera, and the developing and drying equipment.

Mr. Todd reported that regulations governing the use of 16-mm projection equipment in all places except private homes have just been completed by the Chicago Board of Examiners, and will require that only licensed operators be used for such presentations hereafter, the same as in the case of 35-mm projection.

Abstracts of some of the papers presented at the convention are appended hereto:

THE LUMINANCE DISCRIMINATION OF THE HUMAN EYE

E. M. Lowry
Eastman Kodak Co., Rochester, N. Y.

The effect of the luminance to which the eye is adapted on its ability to discriminate differences in luminance, and the effect of the visual angle on this ocular function are discussed. Luminance discrimination depends on whether the observer's attention is fixed on a highlight or shadow region as is shown by data on threshold luminance in scenes in which the luminance varies widely.

INFLUENCE OF COLOR OF SURROUND ON HUE AND SATURATION

David L. MacAdam
Eastman Kodak Co., Rochester, N. Y.

The appearance of a color picture depends on the quality of light in its surroundings. The most obvious effect is a shift of the apparent balance of the picture. Variations of the criterion for white responsible for this shift, and equally important changes in perceived hues caused by adaptation to various surrounding colors, have been determined by color measurements and specified in chromaticity diagrams.

QUALITY CONTROL DEPARTMENT OF A MEDIUM SIZE FILM LABORATORY

Edgar E. Berger
Du-Art Film Laboratories, N. Y. City

Procedures are described for establishing and maintaining quality standards. Methods of obtaining developing solution constancy are detailed. The mechanics of organizing and running printing machine uniformity tests, negative sound and negative picture tests, emulsion tests and other operational control matters are discussed.

SAFETY REQUIREMENTS IN PROJECTION ROOMS AND TV STUDIOS

Samuel R. Todd
Board of Examiners, City of Chicago

Nitrate film has imposed special requirements on projection room design for many years. The advent of 35-mm safety film may change some of these, and this possibility is discussed. The increasing use of films, both nitrate and safety types, in television studio operations calls for similar precautions and the presence of considerable electronic equipment adds to the normal hazards. These hazards and certain others peculiar to live

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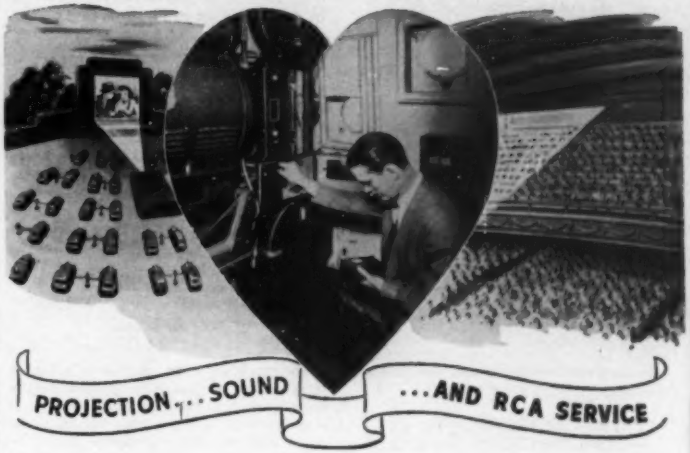

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program presentations are discussed. Safety problems involved in the installation and operation of high voltage television equipment in theaters are outlined.

PRODUCING ELECTRONIC MOVIES

E. Arthur Hungerford, Jr.
General Precision Labs., Pleasantville, N.Y.

Described are the various production techniues for producing high-quality video recordings on a closed-loop basis. Areas to be covered include dramatic, educational, news and sports, and commercials. Accent is on methods to achieve maximum speed of production. Examples of attainable quality are shown.

PHOTOMETRIC FACTORS IN THE DESIGN OF MOTION PICTURE AUDITORIUMS

H. L. Logan
Holophane Co., Inc., N. Y. City

The photometric factors involved in designing the visual environment in a motion picture theater so as to promote the comfort, enjoyment and safety of the audience are discussed.

SURROUND BRIGHTNESS: KEY FACTOR IN VIEWING PROJECTED PICTURES

Sylvester K. Guth
General Electric Co., Cleveland, Ohio

The problem of providing general lighting in areas where projected pictures are viewed and the effects of such lighting upon the projected pictures are analyzed. New data are presented which illustrate the effect of surround brightness on visibility and on viewing comfort. These data provide a simple basis for establishing surround brightnesses in auditoriums for optimum viewing.

NEW APPROACHES BY RELATING FILM PRODUCTION TECHNIQUES TO EXHIBITION

Benjamin Schlanger and
William A. Hoffberg

A larger screen, camera angles, factors of psychophysical vision and auditorium viewing are considered relative to the development of more flexible screen cinematography. Screen masking, surround and auditorium environment are also considered.

NEW SYSTEM FOR MEASURING AND SPECIFYING IMAGE DEFINITION

Otto H. Schade
RCA Victor Division, Harrison, N. J.

The capability of an image-forming device to reproduce fine detail is specified by the characteristics of its point image. Because it is difficult or in some cases impossible to measure directly the point image formed by a lens, a photographic film or an electronic system, the diameter of an equivalent point image of standard shape is evaluated from measurements of the sine-wave response of the device.

The theory substantiating this equivalence, as well as simple practical methods of measuring the sine-wave response of lenses and film, was discussed and illustrated by slides.

NEW PROCESSING MACHINE FILM SPOOL FOR USE WITH 35- OR 16-MM FILM

F. L. Bray
Du-Art Film Laboratories, N. Y. City

After a number of experiments to find the best sprocket and spool combination for 16-mm or 35-mm film, it was decided to use a radically new type of spool distinguished by a tapered profile. The advantages of this design, as applied to sprocket- and friction-drive machines, are given.

16-MM PROJECTION FOR STORAGE OPERATION WITH TV CAMERAS

E. C. Fritts
Eastman Kodak Co., Rochester, N. Y.

A projector previously described for use in professional motion pictures is adapted for television use. The pull-down angle of the intermittent sprocket permits operation on a storage basis with the pull-down action at the normal rate of 24 frames per second. The shutter, on a separate motor, can be run without the film mechanism for single-frame projection.

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cation. The preamplifier is equalized for uniform response to 7000 cycles per second. Low-pass filters offer a choice of cut-off frequency.

CONTINUOUS PROCESSING MACHINE FOR WIDE FILM

H. E. Hewston and Carlos H. Elmer
U. S. Naval Ordnance Test Station, China Lake, California

A new continuous processing machine for wide film is described. This machine carries the principles of motion picture film processing into the field of processing black-and-white film ranging in width from 70-mm to 12 inches. Details of design and operation are outlined.

NEW TELEVISION RECORDING CAMERA

Frank N. Gillette and R. A. White
General Precision Labs., Pleasantville, N.Y.

The camera described has been designed specifically for video recording purposes. To accomplish intermittent film pulldown within the short space of time available, a multiple skip claw movement is utilized. The usual mechanical shutter is eliminated, by the use of an electronic shutter.

In order to obtain the necessary film stability at the aperture, a vacuum-operated film gate is utilized, which permits the camera to be operated for rather long uninterrupted periods of time. Provision is made within the camera for the simultaneous recording of sound, at standard spacing for correct sound synchronization.

INDEPENDENT FRAME: RATIONALIZING PRODUCTION

Lt. Col. G. R. Stevens, OBE
Television Film Prod., Ltd., London, England

To reduce the cost and improve the efficiency of motion picture production, the independent frame technique, sponsored by the J. Arthur Rank Organization of Great Britain, aims at a flow system of production. This method, which has had marked success in a series of experimental films, now is being developed for use with television cameras and for remote direction and editing.

RANDOM NOISE REQUIREMENTS FOR THEATER TELEVISION

Pierre Mertz
Bell Telephone Laboratories

Provisional evaluation of permissible random noise for theater television is considered from several sources of information. For broadcast television a frequency weighting, and limit on weighted noise power, have been used. The finer picture detail of theater television presumes a lower random noise. Changes in weighting curve are discussed. A limit figure of noise is suggested, comparable to graininess effects in motion pictures, but slightly more severe than published performance on camera tubes.

COMPARISONS OF CURRENT PROJECTION SYSTEMS FOR INDOOR AND DRIVE-IN THEATERS

H. J. Benham
RCA Victor Division, Camden, N. J.

Motion picture projection systems are available today in several combinations which meet the requirements for screen brightness recommended by the Screen Brightness Committee of the SMPTE for practically all types and sizes of indoor theaters. Standards for screen brightness and maximum viewing distances have not been established for drive-in theaters.

It is generally recognized that most large drive-in theaters operate with inadequate

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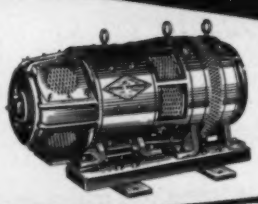

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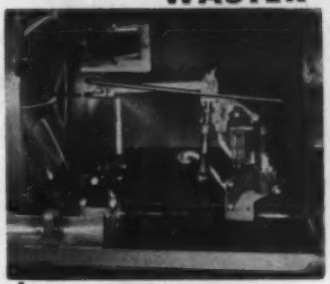

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screen illumination, yet the amount of light produced by their projection system is more than can be used without danger of film damage unless devices are used for cooling the film or removing the heat from the light beam.

NEW 35-MM TV RECORDING CAMERA

John Kiel
Producers Service Corp., Burbank, Calif.

This paper describes a new 35-mm television recording camera, with particular emphasis on the mechanical design features related to the picture-splice. Since certain film phenomena, phosphor persistence, and angular shutter size are directly related to the perfection of splice, these factors and their particular effects are also discussed.

3-DIMENSIONAL MOTION PICTURE APPLICATIONS

R. V. Bernier, Maj., USAF
Wright-Patterson AFB, Dayton, Ohio

Methods of taking and projecting 16-mm high-speed, normal speed, and time-lapse stereoscopic motion pictures of the alternate-frame type are described. Included is a description of a newly patented polaroid method for right and left picture selection as used in the Eastman High-Speed Camera and as used in projection.

Other mechanical stereo systems as used in normal and time-lapse cinematography are discussed. The paper will be supplemented by the showing of a stereo film using a single 16-mm projector equipped with a synchronized drum polarizer in front of the lens and a Morgana-type shuttle mechanism.

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PHOTOELECTRIC METHOD FOR EVALUATING STEADINESS OF MOTION PICTURE FILM IMAGES

R. W. Lavender
Ansco Div., General Aniline & Film Corp.

Comparative data on the steadiness of motion picture film images are generally obtained qualitatively by experienced viewers. Recently, problems encountered in evaluating the relative merits of several proposals for a single-perforation standard for 35-mm motion picture film necessitated the development of an instrument for obtaining specific quantitative steadiness data.

The instrument described, which utilizes variable-area photoelectric recording techniques, provides quantitative steadiness data of the motion picture image relative to the screen and/or perforation. When used in conjunction with a special test screen, the film being tested may be viewed and its steadiness recorded simultaneously.

AUDITORY PERSPECTIVE

H. G. Kobrak, MD
University of Chicago

The principles of auditory localization as related to stereo sound reproduction are discussed. The human head carries on its lateral aspects two biological sound receivers. The position of the receivers and the role of the skull in the sound field are discussed.

The attributes of the acoustic signal (intensity, phase, time) relevant in sound localization are described. The factors of experience and training as well as the stereo performance of deafened ears are analyzed.

REPORT ON SCREEN BRIGHTNESS COMMITTEE THEATER SURVEY

W. W. Lozier
Chairman, Screen Brightness Committee

The Screen Brightness Committee has undertaken a survey of screen brightness in 100 representative motion picture theaters in this country. Progress to date will be reported.

MODIFIED NEGATIVE PERFORATION PROPOSED AS A SINGLE STANDARD FOR 35-MM MOTION PICTURE FILM

W. G. Hill
General Aniline & Film Corp.

The existence of two or more perforation shapes for 35-mm films has, for many years, been considered undesirable. Registration problems are minimized if negative perforations are used throughout; experience, however, has shown that projection life is short.

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THE PRACTICAL SOLUTION TO THE SCREEN LIGHT DISTRIBUTION PROBLEM

Charles R. Underhill, Jr.
RCA Victor Division, Camden, N. J.

Described is a vinylite plastic screen which has the center area compensated for by a greater number of perforations than the edge area.

TEMPERATURE-SENSITIVE PHOSPHORS FOR EVALUATING AIR JETS TO COOL FILM

F. J. Kolb, Jr., and F. Urbach
Eastman Kodak Co., Rochester, N. Y.

Temperature-sensitive phosphors, designed to show a variation in luminescent intensity —under ultra-violet excitation—with temperature of the phosphor, may be applied directly to a piece of film that can be examined in a projector gate.

When this coated film is heated by radiant energy (comparable to the radiant beam used in projection, but diminished in intensity sufficiently to permit the coated film to remain stationary in the gate) temperature differences across the film become visible immediately as differences in the intensity of luminescence. Cooling patterns of various air jets can be demonstrated, and relative efficiencies of several designs can be compared.

MEASURING TOTAL LIGHT OUTPUT AT THE PROJECTION LENS

G. Gagliardi, Warner Bros. Theaters
A. T. Williams, Weston Electrical Instr. Co.

This instrument utilizes an integrating sphere and a Weston Photosensitive meter, used in conjunction with a specially designed film aperture plate which is inserted at the projector gate with holes perforated to give a total light reduction of ten to one. Other plates are available to simulate measurement in the prescribed screen locations in accordance with Screen Brightness Committee Recommendations. Accuracy of this system is indicated to be within ±5% of direct screen measurements.

THE MAGIC OF COLOR

(*Continued from page* 15)

of chaos. The Munsell System blithely ignores the trichromatic character of human color vision and assumes five primary colors! Naturally, such a system must be considered as a makeshift, at best.

An experimental hue scale may be made by dividing a circle into a number of equal sectors and coloring the sectors with appropriate hues in normal order. A circle having 6 sectors colored, consecutively, red, orange, yellow, green, blue, purple, and back to red constitutes a 6-hue scale. Now the question arises: is this 6-hue scale a useful one for the many widely different applications to which such scales are applied? Perhaps we decide that the number of hues is too small, so we subdivide it to form a 12-hue scale as follows: red, red-orange, orange, orange-yellow, yellow, *etc.*, all the way around. Another division of the sectors may be considered necessary to give a 24-hue scale, and again to give a 48-hue scale, etc.

But as the number of hues increases

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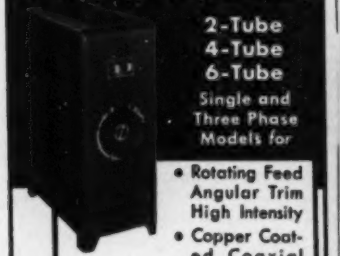

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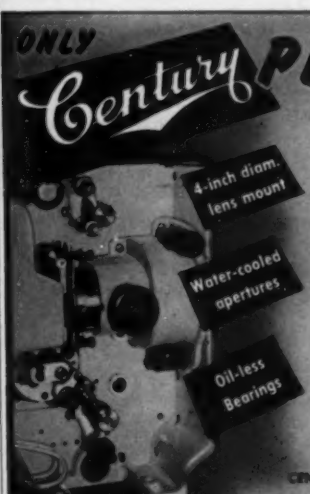

it becomes increasingly evident that something is radically wrong. The hues change too abruptly both in the yellow-green and in the purple-red sextants. Furthermore, the colors of opposite sectors are not always complementary, thus reducing the usefulness of the scale.

True orange and true blue are exactly complementary, but true red and true green are not quite complementary, and true yellow and true purple are far from being complementary. Our original 6-hue scale (as well as all others derived from it) is clearly neither balanced nor equitempered. We may as well throw the whole thing away and start all over again on a different basis.

An Equitempered Hue Scale

The position of hues in the spectrum is of no help in devising an equitempered hue scale. A glance at Fig. 1 shows that hues change rather rapidly in the yellow and blue regions, while the orange, and especially the green, regions are rather extenuated. In order to determine equal sensation-unit intervals we must experiment with a large number of observers.

If such experiments are made, and the results jotted down on a diagram of the normal spectrum, lines spaced similarly to those at the top of the spectrum-band in Fig 1 are obtained. This is data of fundamental importance.

Now, any useful hue scale should be based fundamentally on the three primaries and their complementaries. The hues which most observers call "true" red, orange, yellow, green, blue, and purple should also be included, as these are the most commonly used colors. Other hues will have to be included in order to maintain equal sensation intervals between adjoining hues; and any small irregularities which are present in the data obtained from observers will have to be smoothed out to insure each hue-sector being complementary to the sector directly opposite.

All this can be done; and it will be found that a minimum of 48 hues can be used. Fig. 3 is such an equitempered scale.

A 48-Hue Color Chart

IP's 48-hue color chart has as its starting point, not red as in other color systems, but a strongly yellowish green called *xanth*. This will be found at the very top of the chart. The reason for this choice is that all the hues from chartreuse (moderately greenish yellow) to chrysine (yellow-green) are generally the most unpopular colors in the entire scheme of hues! And xanth, the first hue of the green group, the "sickliest" of all yellow-greens, is flanked by mascagna and chlorise, colors almost as unpopular as itself. A "break" in this region accordingly occasions far less inconvenience to color technologists than a break in the red region.

The 48 hues are given one-word names, not numbers, for identification. Familiar hue names have been retained—the few coined names present are intended to be suggestive of the hues they represent. The wavelengths (millimicrons) of the hues, and also of the dividing lines between the six main color families, are specified. The names of the primaries are printed in capitals; those of secondaries are underlined.

The X in the center of the chart assists in locating the opposite, or complementary, of each hue.

[To be Continued]

B. & K. Chicago Theaters' Net

Balaban & Katz Corp., Chicago theater chain, in 1950 had net earnings of $2,175,354, or $8.28 a common share, compared with $2,805,000 or $10.68 a share in 1949. The company opined that it had now felt the full impact of Tv, although there is "cautious optimism" that good pictures will draw well despite Tv.

The company reported that its own Tv station in Chicago, WBKB, was operated at a profit during 1950, as against a "considerable loss" in 1949.

United Paramount Earnings

Net profit of United Paramount Theatres, Inc., for the fiscal year ending Dec. 30, 1950, the first full year of operation since the divorcement from Paramount Pictures, was $12,351,000. This included dividends from affiliated companies of $1,420,000, and $209,000 of undistributed earnings of partly owned, non-consolidated subsidiaries.

During the year the company ended joint interests in 457 theatres, and disposed of all interest in approximately 241. The latter were jointly owned at the time of the consent judgment in the anti-trust case. The company paid $12,000,000 in cash for the 50% interest of its co-owners in Interstate Circuit, Inc., and Texas Consolidated Theatres, Inc., operators of 160 theatres in Texas and New Mexico.

Estimated consolidated earnings for the first quarter in 1951 were reported at $2,791,000.

Lenses in "Reasonable Quantities" in 1951—Kollmorgen

Projection lenses will be available in "reasonable quantities" during 1951, despite the NPA controls on such essential material as aluminum, which is used in making lens mounts. This is the opinion of Kollmorgen Optical Co., makers of the Snaplite series of lenses.

The firm warned that "delays in shipments due to priority orders can be expected in 1951" and urged that those in the trade "anticipate their requirements as much as possible." It said that in ordering lenses in 1951 "care should be taken to determine the exact focal length required to eliminate delays due to not ordering the correct size."

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★ "The Defense* Bonds I bought through Payroll Savings in '41 helped me to buy my new home!" says ***G. F. Nelson,*** manufacturing technologist at Shell Oil Company. Congratulating Mr. Nelson is Shell Vice President and former Air Force General ***"Jimmy" Doolittle,*** who adds, "At Shell we believe in Payroll Savings—it's a patriotic and *practical* way to do a job for defense!"

★ "The Savings Bonds I'm buying now for America's defense will add almost $100 a month to my company pension when I retire," SP Engineer ***Frank Bacher*** tells his old friend, ***A. T. Mercier,*** President of the Southern Pacific Railroad. "They're an extra step toward independence in which the railroad helped me by encouraging me to join the Payroll Savings Plan."

★ ***Mrs. Eleanor Minkwic,*** drill press operator of Burroughs Adding Machine Company, introduces her Army veteran son Vernon, to her boss, Burroughs President ***John S. Coleman.*** "In 1942 I began buying Bonds through Payroll Savings at Burroughs," says Mrs. Minkwic. "Today they're helping Vernon's G.I. allowance to see him through college!"

TEAM UP WITH THESE TYPICAL AMERICANS IN THE PAYROLL SAVINGS PLAN!

★ ***Pasquale Santella,*** millwright at United States Steel Company's Carrie Furnaces of the Homestead District Works, has a very personal reason for buying Savings Bonds. As he told ***C. F. Hood,*** United States Steel Company executive vice president, "My son Tony, 19, is missing in Korea. Used to be I bought bonds because it was my duty and it was a good way to save money. Now I want to help lick the Reds and get Tony back. I buy one bond every payday and when Uncle Sam needs more money, I'll buy *more* bonds." He has bought bonds regularly since 1943; has never cashed one.

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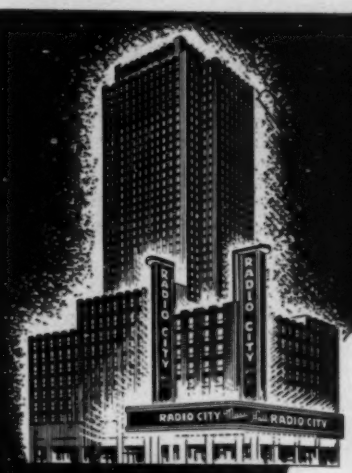

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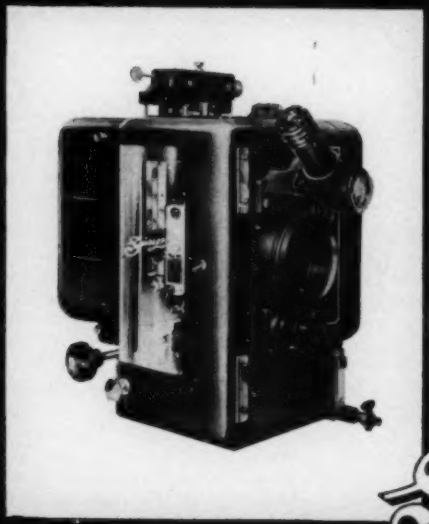

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